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Computer Age

JULY 1981 ISSUE 8 60p

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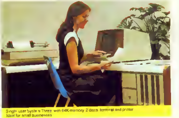

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by Teoman Irmak

Editorial

Seed Money

If history repeats itself (though next time perhaps with a stammer) the computer industry will be one of the few to keep expanding in the face of recession. The developed world is gearing itself up for one of its periodic transformations and those methodologies and technologies which are its tools will flourish but being developed is neither an historical nor a divine right. Taken as a verb the word developed is in the past tense for Britain that is a dangerous time to live in.

We must ask ourselves whether where, and how much we are prepared to invest now for the future Decisions on which areas to invest in are difficult enough for government and industry without what must seem like gratuitous sniping from magazine editorials but cases such as one where half an investment has been made and an enterprise is kept waiting for the rest illustrate the worst possible approach one midway between the present and the future – limbo Clearcut decisions on which areas of computing are to be cultivated must be made now and carried out fast and the seed money must be planted Nero is said to have fiddled while Rome burned At least he was dramatic How is one to describe those who dither while Britain sputters?

A couple of British companies have developed systems created and developed a market only to find a sudden shortage of components and a refusal of further capital Their market slots will be filled by companies from abroad People who are by no means fools argue that we should concentrate on applications software and leave the manufacturing of components and systems to the more efficient But we don't have a monopoly on brains The US and Japan have woken up to the applications software development Once they really get going, they will have the advantage of having the systems before others do

Meyer N. Solomon

David J Salway

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WHERE'S THE SUPPORT?

Smugness should be added to the list of deadly sins

Some months ago I wrote a piece which criticised data processing specialists for being excessively protective of the mystique surrounding their profession (*Computer Age*, February 1980) Managers in other disciplines may have read this with a certain smugness which I now intend to dispel with a barrage of generalisation My contention is that, while this protectionism on the part of the computer people is culpable lack of imaginative support from superiors and insularity on the part of peers is just as significant a factor in many companies failure to make the most effective use of their senior dp personnel

Senior management tend to be very reluctant to spend money on training middle management in basic management skills These include communicating at all levels and understanding how businesses in general and the business' in particular, work Many dp manager fail to 'sell' a scheme, with a resulting disillusionment and frustration not because of any intrinsic lack of merit but because the report proposal or whatever is not couched in the terms which the financial controller and managing director expect It takes education to turn ideas in to positive discounted cash flow and many middle managers, including dp managers rightly feel aggrieved that their superiors are less prepared to provide that instruction than they are to bemoan lack of the results that it would give

The dp manager inevitably recognises opportunities for using technical developments or software, to extend computerisation into new areas The list of these is virtually endless but includes job costing inventory control (as opposed to recording), production planning typesetting, word processing—and each instance brings the dp specialist into contact with a specialist of another sort probably at a similar level in the company hierarchy Since far too few companies have a forum where first discussions for combined operations can take place collaboration usually depends on mutual trust between our specialists Too often an initial approach to the user department by the computer boss results in suspicion and resentment on both sides The user department's unease may very well be exacerbated by long-held feelings that the computer department is staffed by pampered, overpaid prima donnas and the computer boss's by the conviction that many production/print shop/stores/administration managers are hide-bound dullards Like many generalisations each of the foregoing contains an element of truth It should be remembered however that many computer people are ex engineers for instance, and have a genuine and informed interest in engineering or production problems (after all they have control of a production unit) but there are very few production managers who have any real knowledge of computers or the techniques of systems analysis So if your dp manager colleague says that he knows what a parts explosion is take his word for it

A good deal of the resistance stems from the feeling among other specialist managers that their empire is under threat

> ***"It takes education to turn ideas into positive discounted cash flow."***

I offer the following advice Be open-minded about your dp colleague's interest in your area, but be very sceptical at the same time There may well be significant gains to be made from computerisation of parts of your operation Look for ways of making your skills complement those of the computer experts They should be good at introducing new systems, at phasing them in at implementing technical change They should be alive to new techniques of data collection and handling On the other hand they will have little or none of your experience of introducing new systems to uncommitted or hostile staff They are probably poor (through inexperience) at working with your sort of staff particularly in clerical areas—content to earn relatively little to carry out undemanding, repetitive jobs low on motivation, with modest career prospects, used to little or no automation and possibly convinced in a vague way that it threatens their jobs Computerisation schemes may depend on computer department-like staff for success so be particularly vigilant for this flaw However the least that can happen to benefit your department is that an active numerate mind has been brought to bear on some of its problems If an outsider has recognised them they are probably major problems Should you fail to exploit the opportunity to bounce a few ideas around for your own good you have wasted a valuable opportunity and only have yourself to blame A major improvement in your section's performance must be to your benefit, so co-operate

I suggest scepticism because in the final analysis the project would be in your area of responsibility Make the dp man convince you that he has something to offer—if he is not prepared to jump through all the hoops he is unlikely to be thorough and will probably make a botch of your project (Sorry, dp managers, but it has happened too often)

As for suspecting that a colleague in a senior DP role has designs on your empire, that may or may not be the case but then so have your own best subordinates Try to remember what is too often forgotten—one of the factors most likely to contribute to your own promotion is the presence of an obvious successor for your present position

Collaboration in the field of microcomputer applications is particularly attractive The amount of money at risk is comparatively small There is no threat to existing empires, as there is every chance that any such implementation would be totally under the user's control The use of in-house computing expertise could save time money and possibly mistakes The company benefits from consultancy but without the expense, or risk, of using an outside party and the dp manager benefits from being obliged to bring himself up to date on micros and his morale gets a boost from being employed in this kind of role

So, there you have it senior and non-dp middle managers—give your dp manager a chance to sell you some of his pet ideas (or call his bluff if you must be cynical) Those of you who are not supportive or receptive might well be guilty of the sort of casual restriction of a valuable company asset which you would never countenance carrying out deliberately ●

Geoff Norman is a training course manager for Infotech.

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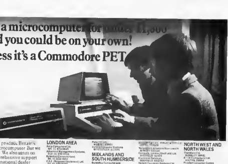

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THE USES OF MICROPROCESSORS

They're widespread now, and are spreading even faster than before

• Geoff Simons is the chief editor of the National Computing Centre (NCC) Publications. He is author of Introducing Microprocessors *(1979)* The Uses of Microprocessors *(1980) and* Robots in Industry *(1980)*

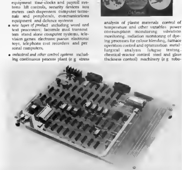
A key characteristic of the microprocessor is flexibility of usage It is quite astonishingly adaptable in scores of industrial, commercial, social and domestic fields To some extent this derives from the character of computing in general In an important sense, computers are "applications independent" potentially useful in a host of unrelated areas even the tailor-made ("bespoke") systems, designed for a specific usage have much in common with systems developed for other purposes They embody analogous control, architectural and stored-program features

Computer usage flexibility is enhanced by the diminutive size of microprocessors Most of us have noticed that micros are small Journal editors are fond of showing photographs of micros set against a finger-nail a tooth or a coin In at least one book a microprocessor is shown passing through the eye of a needle The size of micros allows them to be sited in a wide range of manufactured items where space is limited Hence microprocessors can be added to car electrical systems, artificial limbs laboratory instrumentation, cameras, spacecraft controls, typewriters, etc Computing power can be provided in all sorts of environments and products which would have been totally incompatible with the early electronic computers

We all know that microprocessors are widespread ubiquitous, all-pervasive, etc Microelectronics technology is celebrated in popular and technical media alike with catchlines such as *Chips With Everything Now the Chips are Down* and *The Silicon Factor* The diminutive chip has a large profile in the media Despite this, it is not always realised quite how extensive chip applications have become It is worth reminding ourselves from time to time, just how broad the spectrum of chip usage has become

In a recent Department of Industry publication (*Microelectronics the New Technology*) possible product areas are divided into five categories

- *enhancement of existing products* including domestic appliances (e g washing and dishwashing machines sewing machines toasters vacuum cleaners and ovens), television pre-set digital tuning, vehicle components typewriters navigation equipment time-clocks and payroll systems lift controls, security devices taxi meters cash dispensers computer terminals and peripherals, communications equipment and defence systems
- *new types of product* including word and text processors facsimile mail transmitters stand alone computer systems, television games electronic pianos electronic toys, telephone cost recorders and personal computers,
- *industrial and other control systems* including continuous process plant (e g stress analysis of plastic materials control of temperature and other variables power consumption monitoring vibration monitoring radiation monitoring of dyeing processes for colour blending, furnace operation control and optimisation metallurgical analysis fatigue testing chemical reactor control steel and glass thickness control) machinery (e g robo-



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- *new products or techniques in communications* including data communications equipment for transmitting and receiving telemetry electronic typesetting, document transmission remote terminals in shops and banks radio phone and paging services and electronic funds transfer

In January 1978 the government initiated three studies into the implications for the UK of semiconductor technology. The working party dealing with the application of this technology concluded that certain types of products and services "will have great potential". These included domestic appliances education aids electronics for motor vehicles, energy conservation medical systems security, communications and traffic control. The working party report (*The Applications of Semiconductor Technology* 1978) discusses particular areas in some detail.

Many microprocessor uses are conventional and require little comment. Everyone knows about micros in word processors, in video games, and as aids to education. It may be less widely known that they are being used to control heart "pace makers" and as a means of giving industrial robots the power of choice. Nor is it commonly known that they are finding their way into women's bras! A chip is being developed at D Green Electronics, Glasgow, for use mainly in fertility clinics to help childless women to conceive. The basic idea is that a tiny micro-based device could be fitted into a bra, either as an integral element or an add-on feature to monitor breast temperature fluctuations. A simple thermometer could monitor temperature, but only a micro could make sense of *changes* in temperature. The chip could connect to a suitably positioned numerical display which the user could interpret by reference to a specially prepared code book.

The common and less common uses of silicon chips have contributed to the *microprocessor mystique*, the prevalent feeling in the popular culture that micros are a magic cure-all a solution to all ills. It is possible to trace how the microprocessor image has developed how micros carry with them ill-defined connotations of expectation and technical wizardry.

In the popular culture large computers have long had a forbidding aspect partly because they are incomprehensible to the layman. At the same time they were dubbed "high-speed idiots" and many tales were told of absurdly high billings for domestic gas consumption. These comments represented efforts to protect human vanity, to reassert human superiority over machines. By contrast, the microprocessor, by virtue of its diminutive size, is generally seen as "non-threatening". A quarter-inch square Intel 4004, designed a decade ago may have computing power equal to that of the 30-ton Eniac, completed in 1946.

But a tiny piece of silicon with a few impurities doesn't seem to threaten anyone. Micros have thus emerged as chummy little fellows liable to lurk unexpectedly in kitchens and nurseries as well as in offices and factories, but without a sinister aspect. In fact the image of microprocessors is simplistic. They emerge in a specific social and political context and they have significance in some areas — e.g. police surveillance and military implementation — which are too rarely discussed in the media. Before indicating some of these considerations, it is worth profiling the broad spectrum of specific microprocessor applications.

The PLATO Learning Centre at Wells St London, officially opened by Sir Keith Joseph Bt provides an immediate source of training for industry using the Control Data PLATO computer based training system

In business and commerce, micro-based systems are being retailed for invoicing, inventory control sales ledger, mailing, property management insurance and VAT accounting. For example the IMP (Inventory Management Package) from CPU Computers for the M-ONE system is being used by a tailor an oil company, a car spares distributor, an electrical contractor and a manufacturer of veneered chipboard. Another system, the GEM Time Machine, is being used by US lawyers to record their office time spent working for each customer. Micros are also being incorporated in relatively simple office units, such as copiers and guillotines.

There are diverse industrial applications of microprocessors (some have already been indicated). Factory heating, lighting lifts, security and air conditioning systems are being controlled by micros as are the various aspects of process control. Monitoring and diagnostics, production control quality control instrumentation, weighing and measuring systems machine control — all are increasingly exploiting the flexible and cheap computing power offered by microprocessors. Micros are also bringing new levels of intelligence to industrial robots. And micro-based systems are providing furnace control in the metal industry rotating kiln control in cement manufacture, injection moulding control in the plastics industry mine ventilation monitoring in the coal industry, sugar production control in the food industry and environmental and pest-control monitoring in agriculture.

Mainframes and minicomputers are *themselves* being affected by microprocessor developments as are the associated systems and philosophies. Peripherals and terminals, now often micro-based, are frequently intelligent devices, computing systems in their own right. In the communications industry micros are being used in telephone systems providing switchgear control PABX monitoring, call data registration trunk supervision and other facilities.

Educational applications are leading to such concepts as the "teacherless classroom" and the "electronic blackboard". (Offices without clerks, factories without workers classrooms without teachers — it is easy to see the worries about the micro impact on employment.) In medicine there are micro-based provisions for diagnosis, medical instrumentation, and for the handicapped and patient monitoring (e.g. in baby geriatric and post-operative wards). Micros are being used to monitor heart performance, blood flow, and eye sensitivity. Microprocessor-based devices have been developed to aid the physically handicapped, the speech handicapped and the visually handicapped. For example paraplegics amputees and the blind have been helped by microprocessors. Micros can convert books into Braille and control arm and leg prostheses.

All areas of transport have felt the impact of micros. They figure in cars — to control engine performance and exhaust gas emissions and to provide various sophisticated instrumentation facilities (i.e. to work out journey routes, time of arrival etc.) Some micro systems aid car security and comfort micros can control door locks and chassis suspension. And they are being used to test cars, trains ships and aircraft. Railway tracks are being tested by British Rail using a microprocessor based system. The Advanced Passenger Train (APT) relies on various micro-based facilities, as do signalling systems and automatic revenue collection systems.

Ship communication systems (e.g. marine radar) are often micro-based, and tuna fishermen have been aided by micros. Experiemental submersible craft have exploited the supervisory capability of micros, as have missile submarines and other weapons systems. Attitude control in spacecraft and guidance systems in missiles (e.g. Cruise) are increasingly relying on micro-based facilities.

Micros are being used in domestic systems for lighting and heating control and for security. They are increasingly found in washing machines (e.g. the Servis Selectronic 309), dishwashers (e.g. the Miele 560) and knitting machines (e.g. the SK500 Knitmaster). The micro-based chess computers are familiar to everyone, as are the other computer games and such micro-based toys as the Hornby train controllers and the remote-controlled toy cars from Lesney.

Any catalogue or listing of microprocessor application tends to be formless. The micros proliferate in many fields, but what are the factors that govern implementation? To some extent micros are implemented because it is possible to do so ('we have the technology'). But this is a 'second-order' explanation. Effective implementation requires *adequate funding* — which leads us to sources of finance such as government and the banks that supply investment capital. These considerations conduct us in turn to the views of individual politicians and managers.

We may always suspect, for example, that *military* investment will give rise to a wide range of technological innovation: the Eniac computer was designed to generate artillery firing tables and the Intel 4004 microprocessor grew out of Fairchild's work on military and aerospace applications. Without considerable US government interest it would have been impossible for American companies to develop the Cruise missile, so heavily dependent on microelectronics technology. (It is possible to argue that microprocessor technology was directly responsible for the invasion of Afghanistan! Many pundits take the view that the Soviet government is motivated by fear, and that in circumstances of new threats to its security the Soviet Union is more likely to force the ideological compliance of countries on its borders. A new threat to the Soviet Union was the NATO decision to install Cruise missiles in Western Europe. And these missiles depend for their effectiveness on microprocessor components. Without micros the threat would not have been posed.)

Another obvious impulse to investment in chips is the company requirement for commercial success. Hence the video game market and the private provision of chip-based products for such public enterprises as the Post Office and British Rail. It is impossible to divorce the implementation of microprocessor technology from the prevailing political and investment forces. Micros do not descend upon us as magic gifts from some munificent deity. They emerge within a definable sociopolitical framework.

It should be obvious that there is good news and bad news about microprocessor usage. Micros can help our children to learn and the crippled to walk. They can improve the reliability of international communications (and so prohibit the subversive invasion of one country by another!), and they can enhence the safety of aircraft, ships and nuclear power stations. At the same time they can make it easier, in circumstances of a trend to more authoritarian government, for the police to maintain surveillance over citizens. And they can facilitate the nuclear obliteration of cities.

Micros are morally neutral. They can contribute to any political purpose, serve any cause. No natural benevolence resides in a small lump of impure silicon. It is important that we remember that the micro impact (in many social fields in addition to the much publicised area of employment) is subject to political mediation and control. It would be nice to think that micros will be used solely to serve human interest, to make life more enjoyable and less hazardous. ■

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George Gerhold
& Larry Kheriaty

APPLICATIONS

This is the last article in the series by the authors of Common PILOT. Previous articles appeared in Issues 3, 4 and 5 and the article in Issue 5 gave an overview of the language

In this final installment of our series we will attempt to give some idea of the great variety of instructional applications which the previously described hardware and author language make possible. We will do so by giving examples of a few types of instructional strategy. We will not be concerned with coverage of a wide range of subject areas, for there appear to be no limits on the subjects whose teaching can be enhanced by use of the computer.

Let us begin with the simplest form of instructional dialogue: multiple choice questions. In our opinion multiple choice questions are a relatively poor way to teach, and this application makes use of only a small fraction of the capabilities of the hardware and software. It is easy to program. In our examples we assume that the reader is familiar with the contents of part 3 of this series; we include line numbers for ease of reference.

```
10 T    The major issue in the last
          election was
20        (Answer with a single digit.)
30      1. inflation
40      2. union power
50      3. foreign policy
60      4. credibility of the leadership
70      5 local issues and candidates
80 A
90 M
100 TY  I agree
110 JY  @P
120 M   2!3!4!5
130 TN  Answer with a digit between
          1 and 5
140 TY  I think another issue was more
          important
150     Try again
160 J   @A
170 PR
```

There are a number of improvements which could be made in the example, both in coding and in instructional content. Multiple choice implies a list of sequence of questions. To minimise typing, prior to this code we might include

```
D  M$(50)
C  M$     Answer with a digit between
        1 and 5
```

A student answering a question in a CAI course

and then make the alterations

```
120   ($M$)
130 TN   $M$
```

in this and all other questions.

A more significant improvement is dictated by the nature of the question: the answers are not unambiguously right or wrong. One solution would be to rephrase the question

```
10 T   According to the Times the
         major issue ...
```

reducing both the ambiguity and the usefulness. A better step might be to include appropriate comments for each choice

```
131 M   2
132 TY  Although union power was
          much discussed, most
133     commentators agree that the
          debate centred on
134     whether or not union power
          precluded effective
135     action on another issue which
          was the major issue
136     in the election. Try again
137 M   3
138 TY  Foreign policy was not ... etc
```

(We are illustrating instructional programming, not perceptive commentary on the political scene.) If this is to be used repeatedly (say for review) or for a test, then randomisation of the choices may be useful. Then the number of the correct answer for a particular question is different for various users. Because this is not an article on programming, we will not give the details of the subroutine used to do that efficiently. The randomisation can be combined with the commented version illustrated above. To do so we would make the replacements

```
80 AS  $R$
131       - eliminate
132 T(R$   B$) Although union power .
```

where B$ has been loaded with the number (in character form) of the alternative 'union power' in the randomised list. Line 80 accepts a single character.

Professor Alfred Bork and his co-workers at the University of California at Irvine have devoted some effort to extending the instructional value of the multiple choice format. One possibility is to include *more than* a single correct answer in the list of answers. In our example this would go a long way toward answering questions about ambiguity. One of the objections to the multiple choice format is that a little knowledge often allows elimination of a couple of the choices whereupon guessing among the remainder leads to a misleadingly respectable result. To counter this Bork's group randomly selects answers from a list containing several correct and several incorrect answers and presents those answers *one at a time*. The student must judge each answer to be correct or incorrect without seeing the other choices, either until a correct answer is correctly identified or until a specified number of alternatives is processed. It is evident that the elaborations on the multiple choice format require a language with significant computational power.

	B=1 (yesterday)	B=2 (right now)	B=3 (next week)
A=1 (Bill and I)	went	are going	will go
A=2 (We)	—	—	—
A=3 (They)	—	—	—
A=4 (He)	—	is going	—
A=5 (Mary)	—	—	—
A=6 (Dad)	—	—	—
A=7 (I)	—	am going	—

Table 1

The next step in sophistication of instructional strategy on the computer is drill and practice. The following is a typical addition problem (^ indicates space)

```
10 T   36
20 T  +47
30 T
40 TH^^ ^^
50 AS  #X
60 TH  $B$
70 AS  #Y
80 T
90 T(Y  8 & X - 3)  Very good
100 JC  *P
110 T(X   7 & X   3)  You forgot to carry  Try
       again
120 JC  *A

     PR
```

Line 40 positions the cursor in the units column, line 50 accepts a single digit. Line 60 positions the cursor in the tens column (B$ must be loaded with two backspace without erase characters). Line 80 moves the cursor down to the next line, lines 90 and 100 handle a correct answer. Lines 110 and 120 are representative of what is the crucial component of quality drill and practice/diagnosis of and remediation for common errors. In a useful version of the above provision would be made for other errors, for example if X is not equal to 3 then the user needs to learn than 7+6=13. If that particular error is part of a pattern then a retreat to a lower level of difficulty (i.e. one digit addition) may be in order.

The essence of drill and practice is repetition until mastery is achieved. Although a particular student may need many examples, the teacher should not have to program many examples as separate parts of the program. The key to this is the use of the random number generator. In COMMON PILOT the random number generator is a function used via the compute instruction

```
C N   RND(X)
```

If X is less than one, then N will be a floating point number between 0 and 1, if X is an integer greater than one, then X will be an integer from 0 to X−1. To generalise our previous code we write

```
 7 C S    RND(50) + 50
 8 C A1   RND(S  10) + 10
 9 C A2   S  A1
10 T   #A1
20 T  +#A2
30 T
40 TH
```

```
 50 AS  #X
 60 TH $B$
 70 AS  #Y
 80 T
 90 T(S    10*Y +X)  Very good
100 JC  *P
110 T(S    10*(Y    1) +X)  You forgot to
         carry  Try again
130 JC  *A
```

The first two instructions generate the sum (S) and one of the addends (A1). In this way the whole range of two digits can be covered without generating problems which involve carries into the hundreds position. Provision for errors can still be included by using expressions as in line 120. A number of arithmetic drill programs are on the market which are less capable than this simple program!

More complexity

Thus far the examples have made little use of the features of COMMON PILOT; they could have been programmed in BASIC. Let's now look at a more complex drill and practice exercise: agreement of subject and verb. As in the numeric example we want to make the code more useful by including randomly selected parameters. In this case the complexity is greater because the parameters are alphanumeric and we wish to use the features of the match instruction to allow for spelling errors. The key to doing this is the XI instruction. Our example is based on Table 1.

The student is going to be asked to supply the correct form of the verb *to go*. In the example we omit the initial instructions used to dimension variables etc.

Herein we are illustrating possibilities, so we will not give detailed comments on the code. Instead we will give a copy of a sample run. *(see page 12)*

Notice that the format could be improved by positioning the cursor within the sentence on a CRT terminal. In programming the example a first pass would probably lead to lines 440 to 650 with a specific choice of subject and tense. Subsequent generalisation then would require that code for setting up variables and random selection of specific cases be inserted before the code for the specific question, with only minor alteration of the code between lines 440 and 650. This separation into two steps is typical. We maintain that a teacher could change subjects, verbs, destination, or the comments without unravelling the details of much of this code, a characteristic of a good author language.

Tutorial materials are usually a mixture

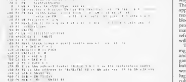
A correct answer!

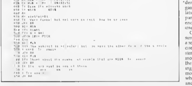
of text and questions. The idea is that material is presented in very small units and understanding of those units is checked by the questions before proceeding to the next step. The material can be new material presented by the computer or the computer can be used to review material initially presented via other media. One of the more successful tutorial programs at Western Washington University helps the students to check their understanding of an assigned reading in political science prior to class discussion.

Usually the coding of tutorial material is fairly simple because random generation is not appropriate. Although the coding is simple, the instructional design is not,

because provision must be made for a very wide variety of answers. Coding for recognition of the wide variety is no problem given the power of the match instruction, especially the OR operator and the provisions for spelling errors. The difficult part is in anticipating the kinds of errors the students are likely to make and even more in diagnosing the source of those errors and the proper action to correct the problems. More than elsewhere in CAI the level of art of the teacher required is much higher than the level of art of the programmer.

No one seems to be able to program tutorial materials completely without feedback; observation of students (direct and through collected responses) followed by repeated editing is essential. In spite of the design difficulties this is a very important type of CAI. In my own field of chemistry tutorial CAI is vastly more effective at covering the connection between the reaction stoichiometry and the equilibrium expression than any lecture or textbook.





Gaming and simulation

Gaming and simulation is the most easily accepted form of CAI. Because this technique allows new classroom activities which cannot be handled in any other way, it is not threatening to the teacher. That is, gaming and simulation does not appear to force teachers to rethink and reorganise their way of teaching large blocks of the current curriculum. Also the programs are fun to run. In our experience many instructors who will absolutely refuse to use drill and tutorial materials will adopt simulations readily.

There are two main problems with gaming and simulations: educational value and coding. There are large numbers of games for microcomputers in circulation, but very few of them teach anything worthwhile. Most of them have a very high level of simulated violence. The difficulty of designing appealing games is evident when we look at traditional board game market; a new success is rare. Simulations are somewhat easier to produce, particularly in the social and physical sciences where simulated laboratory experiments are very useful.

Coding is more complex in gaming and simulation because there is not necessarily a set of logical pathways through the exercise. Coding may be fairly simple if the simulation is based on a mathematical model (e.g., investigate the properties of the damped harmonic oscillator by varying the parameters in the equations of motion), but in a more general simulation where the feedback is elaborate and varied and the range of student responses is large, the coding problems are serious. However, the usefulness of a quality simulation is such that the effort in design and coding is well spent.

Let us describe two simulation programs to which we contributed. The first was a student project in a workshop. The creator wanted to put the user (typically a student in a course in management) in the position of arbitrator in a labour dispute. Clearly this simulation required that some structure be imposed on the user responses. The structure chosen was a branching tree with each branch point represented by a multiple choice question. While this sounds stilted we found that enough flexibility was available for the user as arbitrator to lose control of the situation by selecting provocative response or by favouring one side or the other, that is, the simulation was instructive. We feel that the limitations of the program are more related to the scarcity of choices at the branch points than to the underlying structure

The second simulation is a chemistry laboratory simulation. In this one the student works in the real laboratory to obtain a fact sheet about the behaviour of certain ions. The computer is used to generate a series of unknowns of increasing complexity which contain specified numbers of the ions. The student task is to organise the facts into a coherent, logical sequence of steps which will lead to identification of the unknown. There is no correct sequence: the computer does no prompting. The computer simply informs the user what has happened as a result of each step, allowing the student to take any action at any time. We find this to be a very valuable addition to our laboratory program, for it is very different from our other experiments which tend towards cookbook detail. The students get more of the flavour of science (What should I do next? What do I know at present? What are the possibilities?) they learn something about logical organisation and problem solving, and they learn some descriptive chemistry. The value of the program is indicated by the incredible reduction in time most students require to solve the first, very simple problem, compared to the last, complex problem. After stumbling, they do find their way.

We hope that these examples have given you some idea of the incredible range of possibilities for a CAI system based on good hardware and a good author language. For too long, teachers who wish to use the computer have been hindered by inappropriate languages and by restrictive prompting systems which forced everyone into using the same few instructional formats. Now we have taken a long step towards freeing teachers to give full rein to their creativity in this area. ■

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George Gerhold is Professor of Chemistry and Larry Kheriaty is Chief Systems Programmer at Western Washington University, Bellingham, Washington, USA.

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JANE AND THE PIRATES

The ITMA Project has its full-time staff at the College of St Mark and St John Plymouth The first article on the Project appeared in Issue 5 This series has been extended to include a fourth further article from the fourth newsletter and this article will appear in the next issue

This further article concerning the ITMA project continues in the same style as the last two articles The index of the third newsletter is given – the articles extracted illustrate some of the project s work in curriculum development

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The Geography Computer Group

A number of opportunities have occurred in the last two months for showing the China Clay program to teachers and for using it with groups of pupils

A group of 6th form geography teachers at Dartington were able to view the program and initial interest in using the program with teaching groups was encouraging Several useful points emerged from the discussions which followed Primarily, it is apparent that teachers would like accurate data on *production* and *transport costs* to use in conjunction with the program This information is being requested from the English China Clay Company

Trials have been undertaken with two small 6th form groups and one small 3rd year group from different schools Initial impressions suggest a variety of ways in which this program can be used with children in a range of age groups There are a number of problems the group will meet to discuss these in the near future Problems include

- The use of a matrix for identifying places on the map The grid cannot be used for six figure references and it has been suggested that this would be useful for geography
- The amount of time it takes to use the program to teach any one concept It is proposed that some 'good examples' be prepared for use by teachers initially Subsequently individuals will be able to use their own examples
- The time taken to work out a 'best site' for a factory It is desirable that some work is available for pupils to complete while the best site is calculated by the computer A variety of possible exercises will be prepared by the teachers group

A number of schools are keen to try the program over the next three months If there are any *other* teachers who would like to try the program with their groups please contact one of the research team It is possible to organise a session in the College or alternatively school visits by members of the team with the equipment can be arranged

SB

Mathematica Group

The mathematics group is now established as a separate group from the computing studies and programming group Some members are unfortunate enough to belong to all three working parties and still seem to survive cheerfully!

We have discussed observation of the teaching units and have also exchanged ideas on development of new units

JANE and PIRATES are the two programs that are on trial at present JANE is a program that assists the introduction of the idea of mathematical function and was described in some detail in the ITMA Newsletter No 2

We have been very pleased to extend the observation of JANE into the primary school Both staff and children have quite quickly learnt how to control the program One of the most popular uses of the program with these younger children has been to use the (I) route that sets up the inverse problem This illustrates subtraction as the inverse of addition and division as the inverse of multiplication The program, as is often the case with work with 8/9 year olds, is restricted to integers

This tends to imply that multiplication and addition always "make numbers bigger and that division and subtraction always "make numbers smaller" Should children be encouraged, at the early stages to think in this way? How should we encourage children to view these operations? The mathematics and the primary group welcome readers comments and ideas especially as a unit planned for development will be involving the idea of directed numbers

More detailed reports of observations will appear both in the newsletter and in the project's publications We are spending much time in discussing how we teach in mathematics and I am sure it is true to say that in each curriculum group the emphasis is very much on the teaching, with the computer aid focusing the discussions

The second program that is on trial is called PIRATES PIRATES is a program that was developed some time ago It sets up a game of hunt the treasure It is written such that the teacher can choose the form in which the clues are given

The original program was in 2 dimensions and the clues concentrated on providing work on

a) Plotting simple co-ordinates
b) Recognising straight lines parallel to the axes
c) Regions bounded by these lines
d) Intersection of these regions

The program is now extended to include

3 dimensions if you wish and extra clues to provide work in

e) Vectors
f) Bearings
g) Compass directions
h) Distances

A draft version is on trial with the schools whilst animation and improved presentation of the clues is being developed Also the structure described in program design is being added

PIRATES presents a game environment which certainly motivates the children considerably It is well worth considering, when designing a new program as to whether it is a suitable topic to benefit from being built into a game environment PIRATES is designed to produce a great deal of pupil activity – the machine does not 'do the graphics the pupils are encouraged to do all the graph plotting themselves I think we should be cautious about allowing the machine to 'do too much mathematics for the pupils especially now that good graphics are so easily available

The new programs that are being considered by members of the mathematics group are

1) A program to help drill and practise in plotting straight lines and regions
2) A program to illustrate matrix multiplications
3) A program to help with the teaching of long multiplications

All the programs so far have only used the low resolution graphics on the Research Machines 380Z We have recently fitted our machine with the high resolution graphics which will allow us to explore further topics

The Schools Council Project 'Computers in the Curriculum has already been developing graphics routines for the 380Z and Apple computers which should prove very valuable The mathematics group in Birmingham with Mr Peter Smith in charge of program development would be pleased to give readers details of their progress

JANE and PIRATES will be available from our publishers next summer The teaching booklets will include a lot of information concerning the variety of ways in which the programs can be used in the classroom

RF

• Newsletters can be obtained from the Project Secretary College of St Mark and St John Derriford Road Plymouth PL6 8BH — at the cost of £1

The ITMA Project has an interactive program running at the SCIENCE MUSEUM Challenge of the Chip Exhibition It illustrates some of the features of a microcomputer that a program designer can use but it is not an educational program

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Patrick Sutton

Programming in Standard FORTRAN by A Balfour and D H Marwick (1979, Heinemann Educational Books 388 pages £4 50)
This book is a definite must for those amongst us who know that FORTRAN has its faults when compared to some modern computer languages, and yet still have a soft spot for it

Programming in Standard FORTRAN 77 introduces the new A.N S I standard (as defined by the X3J3 Technical Committee) for the language in an eminently readable way which stresses good programming technique with special reference to program portability Sections covered include program design, data types and constants, program structure and layout various FORTRAN facilities

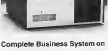
The book gives a very solid account of the language, and its approach makes it suitable for those with previous experience of FORTRAN and also those just starting in scientific programming Each section includes set problems with solutions to some of them given at the end of the book

The appendices cover a comparison of FORTRAN 66 v FORTRAN 77, a summary of executable and non-executable FORTRAN statements and references are given for sources of information cited in the text My only regrets after reading this book are that it was not available when I was using FORTRAN In summary, then, a very good account of FORTRAN at a very reasonable price congratulations to the authors and the publishers

◆ ◆

Software Debugging for Microcomputers by Robert C Bruce (Reston Publishing Company Inc 350 pages £7 10)
This is a clearly written and well presented book which introduces the major techniques employed in software debugging

Intended for use both by programme designers and users of software packages, the book tends to be more tutorial in style than a reference work Many examples are given throughout the book the language used being BASIC and the examples having a scientific bias, although the debugging techniques introduced are of course applicable to many situations Every programme appearing in the book was developed and run on a 32K Sol/20 microcomputer, so users of this particular machine may have an added interest in the book *Software Debugging for Microcomputers* is broadly divided into two main sections the first covering techniques such as flow charting commenting of source code, forcing etc and the second describing the use of such techniques in programme debugging Chapter 8 covers the technique of block debugging which should be of particular interest to programmers using a block structured language such as PLM, PASCAL etc the final chapter, chapter 10, brings together the ideas discussed in the earlier chapters, by describing in detail a particular debugging session on a programme



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CREATE KC$="CREATE 0:MAILFILE 120 15 1" SYS 24576 This example tells KRAM to create an indexed file called MAILFILE on the disk in drive zero with a record length of 120 characters and a key length of 20 characters which starts at position 1 of the record. KRAM looks at the RESERVED variable KC$ to identify the function and its parameters; the SYS call tells KRAM to execute the function. The record length can be any value up to 254 characters and the key up to 48 characters, a total of 302. KRAM packs as many records into the 255 character disk block as necessary.

OPEN KC$="OPEN 0:MAILFILE" SYS 24579 This tells KRAM that we will want to make accesses to the file called MAILFILE on the disk in drive zero. KRAM returns in position zero (peek (0)) the file number by which this file can be accessed during the rest of the program.

ADD KC$="ADD 1,NA$,AD$" SYS 24591 This tells KRAM to add to file number one the data in variable AD$ whose key is NA$. For example in a mailing list the key NA$ might be the name "SMITH A.J" and AD$ might be the address "120 HIGH STREET ANYTOWN". Any normal string or character string variable can be used to denote the key and the record.

GET KC$="GET 1,NA$,AD$" SYS 24582 This tells KRAM to get from file number one the data belonging to the key NA$ and put it into variable AD$. In our example if NA$ was "SMITH A.J", KRAM would read the address "120 HIGH STREET ANYTOWN" from file and put it into variable AD$. If we weren't sure of the exact surname we could give KRAM the key "SM" and it would get for us the next alphabetically higher name beginning "SM" together with its address! Or if we gave KRAM a blank key it would find the first name and address on file.

READ KC$="READ 1,NA$,AD$" SYS 24585 This tells KRAM to read the data belonging to the next highest key following the name in NA$ and put it into variable AD$. In our example a complete file of names and addresses could be read in alphabetical order starting at any name in the file simply by executing successive READ commands! For instance having got Mr A. J. Smith from file, executing the READ command as above would get us say "SMITH M." in NA$ together with his address in AD$.

READ– KC$="READ-1,NA$,AD$" SYS 24585 This works like READ except BACKWARDS! It tells KRAM to read the item belonging to the next lowest key preceding the name in NA$ and put it into AD$. For instance, having read "SMITH M." with the forward read, executing the backward read as above would get us "SMITH A.J" in NA$ together with his address in AD$.

PUT KC$="PUT 1,NA$,AD$" SYS 24588 This tells KRAM to rewrite to file number one the data in variable AD$ which belongs to key NA$. For instance, if we wanted to change Mr A.J. Smith's address we would simply set NA$ equal to "SMITH A.J", AD$ equal to his new address and execute the PUT function.

DELETE KC$="DELETE 1,NA$,AD$" SYS 24594 This tells KRAM to delete from file number one the key contained in NA$ and its associated data contained in AD$. In our example to delete Mr A. J. Smith from the file we would simply set NA$ equal to "SMITH A.J", AD$ equal to his address and execute the DELETE function. KRAM will release for further use the disk space made available by the deletion.

CLOSE KC$="CLOSE 1" SYS 24597 This tells KRAM that file one is finished with for now. KRAM updates the BAM on disk but the file can still be used without another OPEN command.

INITIALIZE SYS 24600 This function is used at the beginning of each program to clear KRAM's work areas and buffers.

The examples above illustrate the use of KRAM in a mailing list application with disk access times of less than one second. KRAM can of course be used in any application program with the Commodore disk where programmer time, user time and disk space are at a premium.

Each KRAM package includes a ROM which plugs into the middle ROM socket of the 16K/32K Pet, a demonstration disk with a mailing list program and a 40-page User Reference Manual. KRAM is available by post (cash with order) price £115 including VAT, or by credit card phone the KRAM 24 Hour Order Desk on 01 546 7256 or see your nearest dealer. (Quantity discounts available)

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Conversation Piece

This is a not-quite verbatim transcript of a chat with the Research Machines 380Z using one of my conversational programs I have tried to use the medium as the message or something like that I mean – I hope it explains itself

I assert that, under certain (probably ill defined) conditions the process the experience and/or the concept is art If you disagree it doesn't really matter does it?

As a matter of interest, the programs run in about 8-16K of memory depending on their complexity If anyone would like a BASIC listing, which they can alter for their own purposes, I'll send them one (the 380Z version but it is adaptable) for £5 or on cassette if you run a normal 9K basic for the 380Z

If then, I receive lots of money I shall buy floppy disc drives for the 380Z and change the world, etc Commodore publish two versions for their PET machine on a games cassette In an interesting printing error their catalogue states that the program has been used – not by psychologists as I wrote – but by pathologists That particular program is called Abuse , and it's very rude to you This one said this

Me Can I talk to you for *Computer Age*?
IT Why n

No hang on (This is me writing again – I just had a thought) Maybe £5 is a bit of a rip-off even though it is in such a good cause I tell you what – £4 for the listing or cassette but 'FREE' if you send me in exchange, any nice program as listing or cassette to run in BASCG – that's the new High Resolution Graphics BASIC for the 380Z Not the disc version unless it's ok for cassette too I haven't *got* discs that's why it's well alright £3 Three pounds – and if two hundred people respond that's hang on where's my calculator yes £599 999 Then I can get the discs

Well I suppose if you *promise* that two hundred people write to me for the program then I'll be able to get the disc drives so you *could* send me programs written in the disc version of the High Resolution BASIC, then I can use them later on

The reason for wanting to get some more programs is that at this early stage one could learn a lot about the possibilities of a new language by seeing how other people use it rather than just spending weeks at it oneself Up to now though it certainly looks promising – animation, for example looming large

Perhaps we should start again

ME. Can I talk to you for *Computer Age*?
IT Why not?

(I'll leave off the labels from now on – if you can't tell which is me and which is the computer good! (I think))

I want to explain how you work

You want to explain how computers work?

No not computers – I mean this program

You mention 'computers Brian I have, associated with that concept 'program' and artwork

So what?

I don't know

Why mention it then?

You tell me

I can't predict what you're going to say

Not at all?

Well – not usually You don't have many preset responses do you?

What shall we talk about?

See what I mean? I'd hoped you were going to respond a bit more intelligently – but that's difficult to simulate unless I program you with all the 'right answers

Meanings change all the time

Thank you – that was a preset response

You picked up on 'mean'

Is that to do with what you said before about right answers ?

Yes

Really?

Yes

Go on then

Thanks I wonder if we can show how you're different to programs like Eliza that just reflect back what the user types in

You wonder if we can show how computers're different to programs like Eliza that just reflect back what the user types in?

Oops! What a give-away OK I know you can do that too – but you have ideas of your own don't you?

Knowledge is a problem for me

It Is is it?

What makes you so sure?

You said so! Say something interesting

'Something interesting'

Ho ho ho

Want to see what I'm thinking about ?

No

Get on with it then

What is art

Is it?

I'm sorry – I mean what is art with a question mark?

Tell me something about you

I programmed you

I am a programmed computer

I know

You know?

Yes

I'd quite like to talk about the idea that a computer program can be an 'artwork just as much as a painting poem or performance

You see! You put that sentence together yourself didn't you

What would an artistic computer be like? It certainly wouldn't just draw silly pictures and all that 'computer art nonsense

Never?

Never

It's hard being a computer but can we discuss art a bit more?

Sure But let's talk about how you generate sentences

Am I making sense?

Yes you're doing fine I want to show how you've got lots of what I call 'empty sentences that you fill up with words

I don't understand

You've got things that say 'noun verb adjective noun etc – and you use your semantic structures to help flesh them out

Have you ever seen a computer in an art gallery?

You've been in one – I saw you there

Have you thought about a program as design ?

Frequently And then you try to spot nouns and noun phrases in what I say – right?

If you say so

I do

You do?

I do

Tell me more about yourself

I am using you

You are using computers?

Sometimes

What?

You didn't understand that did you?

I'm trying to make sense

I realise that You're a clever computer

Thanks

Don't mention it

What is 'it'?

Is it?

What?

And so on When I use the programs, I can of course make the conversation go, to a degree in a given direction To that extent, this transcript was a bit naughty because I wanted to make the machine display some of its tricks, so you'd begin to understand how it works I knew with perhaps 50% probability how to make it go to certain themes

All I can say is that people have used a similar program for hours, and had to be dragged off the keyboard

The first version was called MARTA, standing for Modest ART Answerer and my Italian girlfriend's name It ran in the Whitechapel Art Gallery in the Art for Society' show about two years ago and took about six months to write on and off

During that show a wide variety of people used the program It was school holiday time and lots of kids came along A few of them had difficulties relating to the machine at first (You type stuff in via the keybord the computer responds on the tv screen)

Curiously (it seemed then – not now) the greater the initial difficulty, the longer people stayed with it in the end I remember one boy about eleven years old, who had some sort of motor problem with his hands He had the utmost difficulty finding and then hitting the right key taking perhaps five minutes to type in a sentence this long

Then, as he stayed and stayed, sometimes leaving the machine to others and returning after they'd gone it became clear that he was getting better and better He soon understood all about the program, and sometimes could predict what it was most likely to say He came back frequently that week and when he wasn't using the keyboard he hovered near it helping adults if they seemed perplexed

Later versions of conversational programs – running on my own 380Z as opposed to the earlier (blue!) one that I borrowed for that show – ran in the Design Centre, the Science Museum and on LBC

Discourse

radio in London Each used a different set of basic concepts which it talked about

The Design Centre program got off on Airport Design the LBC version was more general, since it was supposed to respond to listeners during an hour-long phone-in programme That's the nice thing about the programs – one can quite substantially alter what they will talk and ask questions about: in general the more specific it is, the 'better' it will be at making sense

The trouble is of course that if the program is good at talking about for example tribology (the study of friction and wear – something that is often on my mind) then it won't be very hot on general chit-chat And it will never ever (though many ask it) know who won the F A Cup in 1952, or the winner of the next Derby

Now again is this art or 'art' or even ART?

There is much to be said for the idea that *anything* is art, if someone says that it is I won't rely upon that argument here, but it is worth mentioning It means for instance that if someone holds up a teacup saying 'I am an artist and this is art then (if you go along with my hypothesis) you must consider the teacup, or perhaps the person and the teacup as art You may conclude that it's a very *bad* art but that's ok because you may also begin to question what it means to make art what galleries are for and so on (Of course you may conclude that both the person with the teacup and myself are quite mad – but then I'd like to hear *why* you think that)

As I said I won't be using that argument (even though slyly slipping it in) to justify conversational programs as art

What I will say is that surely there is a sense in which thinking, writing and speaking about art (or computers etc) is as important as actually doing it – (let's say at least, neither to the exclusion of the other) Thus discourse on art (etc) when displayed or published may make reference to the elements processes and systems etc of art ( )

It may then contain these aspects – it may treat of them portray them represent them, or present them for critical discussion Is not a good painting only art by virtue of its capacity to move or something?

But supposing I write about this painting print a copy of it refer to it or conjure it up Is this new work not moving too? If not why not?

And so on, and so on There are things to be discussed here But let me finish on another related matter perhaps more apparently oriented to computers

Most CAD – Computer Aided Design – should be reconsidered because of the following: Whatever else computer graphics and design may be representing with their straight lines values, shading and colour they are almost certainly *not* representing anything about the building or product or system etc just by itself

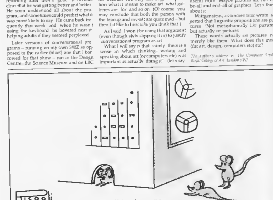
Perhaps what we see on a computer screen should not (or does not?) represent some aspect of the real world out you know there Perhaps it represents something far more interesting and complex – and we should consider this act of representation in greater detail than, presently, we do

It may be that words are nearer to some useful truth Maybe pictures are not the be-all and end-all of graphics Let's think about it

Wittgenstein, a commentator wrote asserted that linguistic propositions are pictures 'Not metaphorically *like* pictures, but actually *are* pictures

These words actually *are* pictures not merely like them What does this mean (for art, design, computers etc) etc?

The author's address is The Computer Studio, Royal College of Art, London SW7



I didn't realise Mick was in computers.

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A MORATORIUM ON PROGRESS?

The road to hell may be paved with silicon chips

And sometimes we are devils to ourselves
When we will tempt the frailty of our powers
Presuming on their changeful potency
Troilus and Cressida

The months of May and June saw the biggest union representing higher-grade civil servants (the SCPS Society of Civil and Public Servants) recommending that their annual conference approve a union Paper to resist the use of new technology in Whitehall. In an attempt to stiffen opposition to the planned introduction of microprocessors in government the Union is exhorted to back the policy of placing a moratorium on such national developments pending a full national agreement with all staff unions representing civil servants.

There are at least four computer projects which have been, or are, threatened with delays because of union resistance, including the Computer Assisted Placing in the Area of London, which is the Manpower Services Commission's scheme for improving the speed of matching unemployed people with vacancies.

Also affected is the Data Transmission System for Local Office Benefit enquiries a Dept of Health and Social Security project designed to speed the answering of social security benefit enquiries.

The Word Processing Experiment at Darlington is a project in the Department of Education and Science designed to use microtechnology for work done in the typing pool of any government department. The Central Computer Agency had intended expanding this Darlington project to test its efficiency in about twenty stations carrying computerised keyboards. However the SCPS have resisted such an expansion.

The SCPS are to recommend that the Union's annual conference approve a union paper which gives a warning that the Government is 'seeking to reduce Civil Service employment as much as possible and seeking to use new technology to achieve this.'

Although the SCPS welcome the various projects, in particular the MSC's Computer Assisted Placing, they feel they should be used to expand the service rather than cut staff. And that is the crunch of the matter for the Government feels that staff savings should be achieved by these and similar projects.

> *'Redundancies will be the inevitable consequences of innovation in some cases'*

The staff side of the National Whitley Council has been pursuing negotiations with the Civil Service Department on the introduction of the new technology, but it was doubtful whether a national agreement would be reached before the Union's annual conference.

Reaching a national agreement will not be easy but it is essential that a Government policy be produced. If the Government is to convince the rest of industry that microelectronics and its widescale adoption is vital for UK competitiveness, then the reaching of a national agreement with its own unions should reflect the benefits of such technology for society as a whole.

The problem facing the unions is that they already live with the unacceptable faces of 1½ million unemployed.* If the Government is insistent upon the introduction of microelectronics and with it an achieved ratio of staff cuts, it must produce a policy on the resultant unemployment – at least.

The Darlington project has already shown gains of productivity from 10 to 70%, and spread throughout Government agencies, the unit costs and staff savings could be enormous.

What kind of changes in the employment package would or could Government agencies recommend in order to avoid the wide scale staff cuts the unions are resisting*? For example, would the Civil Service Department opt for a reduced weekly, or yearly, working time – or a reduced working life?

What kind of changes in the balance of skills requirement will be acceptable to the Civil Service unions?

Answers to questions like these and a National agreement, would help to provide some guidelines to the manufacturing sector which is constantly being urged to adopt the microchip to improve competitiveness and efficiency.

A cursory sample taken of some thirty manufacturing organisations revealed little enthusiasm for microtechnology although they were aware that its introduction was inevitable. The apathy was caused, in the main through the lack of *consistent* and *comprehensive* policies in two areas.

One executive referred to the hardware situation in that there appeared to be few guidelines available to industry on hardware standards. In other words as far as the *user* is concerned there is no BSI (British Standards Institution) equivalent in the hardware market, and he feels he is at the mercy of the most effuse and effulgent manufacturer.

The majority of the sample had no 'procurement' policy for microtechnology, and had little information or perception about introducing such a strategy. The result in some of the companies sampled was a sprinkling of VDUs whether computer peripherals or as part of word processing systems, which had appeared piecemeal in various parts of the organisation.

The second area of misgiving expressed by firms in the sample concerned the whole area of people welfare and employment prospects. The 'piecemeal' approach mentioned earlier was considered partly responsible for this. In that the random imports of hardware into a company caused an increasing anxiety about possible job redundancies, de-skilling of jobs, work re-organisation and health hazards.

Caution

However, most firms also felt that they must proceed with caution when considering the introduction of micro-electronics as there were few consistent guidelines to go on, when reviewing the long-term employment implications Without this the companies felt it was difficult to produce a firm corporate policy which could subsequently be 'sold' down the line Therefore, some kind of national standard or example, would bring some calm to the confusion, or so it was felt

---

* *Dept Employment stats. released April 1980 showing no. out of work as 1 522,921*

It is not therefore just the trade unions like the SCPS who place a moratorium on the introduction of micro-electronics Employers also show a relatively low rate of adaption to date especially in the manufacturing sector

The employment issue is a crucial one, both at national and local levels and is no doubt a major reason why the UK is slower than most of its competitors in exploiting the new technology

The Dept of Employment's Manpower Study Group visited Japan** to discover how the Japanese managed to be in the forefront in utilising new technology without eliciting fears about unemployment – and in fact how that country has so far managed to preserve full employment, albeit superficially

The conclusions, in the view of the Study group are interesting, and are essential elements in explaining why so much of our manufacturing industry (and its trade union membership) are apprehensive about the employment implications of microelectronic technology

The essential prerequisites to successful adaption in Japan were

- the lifetime employment guarantee given by Japanese companies to their employees
- the willingness of companies to diversify and expand output in order to honour those guarantees
- a company union structure in which craft demarcation is not a significant feature, and
- a generally high standard of initial education supplemented by company training, making for a highly flexible and adaptable labour force

There are a number of parallels for most of these conditions in UK industry, and there is a high correlation between the presence of these features and the high rate of innovation in the companies in the UK who have adapted micro technology However, such companies are more the exception than the rule

The 1979 TUC report "Employment and Technology interestingly enough puts forward a suggestion that is already standard practice in Japan It suggests that major innovations within an organisation should be the subject of technology agreements between managements and employee representatives

Relationships

The job-destroying potential of new technology has (and this quite naturally) been a subject of considerable concern to all trade unions, not just the SCPS mentioned previously

'Technological agreements' along the lines indicated by the TUC suggest that there should be early and comprehensive consultation with all concerned with full union access to information There should also be joint union bodies on the employee side This would go some way to allowing craft demarcation not to be a significant feature when introducing micro technology in any given area, which has been the case in recent disputes

The TUC report suggests that new technology should be seen as providing opportunities for increased output and/or diversification and wherever possible job security should be guaranteed as should individual earnings and status Appropriate training for job adaption should also be provided

Not all these suggestions will be appropriate to all individual circumstances and the TUC document itself accepts that redundancies will be the inevitable consequences of innovation in some cases Many of the firms I have been involved with wish to be able to deploy skilled labour with much greater flexibility, especially if they are to utilise new technology successfully Probably the biggest debate, therefore, in the UK will be whether various unions recognise this management wish and that it will be an important *quid pro quo* that they will have to offer if they expect managements to accept the various elements of the TUC approach especially concerning guaranteed job security earnings and status

It is just such a dilemma that the Civil Service Department faces with such unions like the SCPS and why the reaching of a national agreement will be of interest to various sectors of UK industry desperate for both guidelines and a model

'In so far as they have an impact, new technologies increase productivity'

The employment issues and implications are confusing and there is no doubt that it does fog the mind and attitudes of managers and trade unionists trying to agree micro technology policies On the one hand the Dept of Employment Study group in its report the Manpower Implications of Micro electronic Technology (Jan 1980 HMSO), hold a view that any reduction in manpower as a result of micro electronic technology will overwhelmingly be achieved by natural wastage and that this applies equally in the manufacturing and service industries They feel that the jobs "wasted will be relatively low in skill content and this will mean that the brunt (if any) will largely be borne by school leavers or would-be re-entrants to the labour market

In this sense therefore, the solution to the problem is more in the field of initial education than re-training On the other hand, some groups like the trade union APEX cautiously estimates a reduction of ¼ million clerical jobs by 1983, and have said that predictions derived from the Dept of Industry economic models conclude that electronic technology may result in a reduction of 800 000 jobs by 1983, compared with those jobs which would be created in its absence Almost all these jobs would be in the clerical and related fields

However, there does seem to be a consensus that we in Britain have no option but to adapt to micro electronics and other technologies at least as fast as our competitors At the end of the day the *real* problem is in restoring full employment 'how do we get real output growing fast enough to provide enough jobs?' and it is unlikely that this could be achieved without investments in new technology Certainly the history in economic terms of the entire industrial age has been that technological change has been beneficial to *aggregate* employment, although there have been implications for special groups of workers and skills

The Treasury's projections for the next four years assume that productivity growth for the whole UK economy will be around 1 per cent a year Although that figure may only be an assumption rather than a forecast it is broadly in line with most economists' expectations

Productivity

A major point to recognize is that in so far as they have an impact new technologies increase productivity Britain's economy over the last years has not achieved a high productivity growth and there is not much sign that this is about to change There is hardly any indication in the Treasury's or economists' projections that technological change and manpower savings will be the causes of unemployment over the next few years, as some of the nonsense written on the impact of microprocessors on employment predicts It is probable that any overall impact on jobs will depend more crucially on an unforeseeable economic climate than on any technological developments as such

It is precisely this latter point that has resulted in some of our more competitive companies adapting to computer technologies, at a faster rate than much of UK industry Analysis of the possible impact of new technology upon overall situations, employment or otherwise, can best be attempted on the basis of looking at actual effects of applications to date, especially where it is possible to look at the experience of those companies which have moved faster than others in the application of such technologies and are therefore along the path where other users may be expected to follow

It is for this reason that the recently pub-

** *New technology the Japanese Approach Dept Employment Gazette July 1979* lished report of the Computer Services Agency (CSA)/Dept of Industry (DOI) Text Processing-Office Automation Project is of unique value to organisations [March 1980 CSA] The main part of this joint study has been to identify the business needs in a cross section of ten organisations and then to develop the technical requirements and facilities necessary to satisfy those needs

The first part of the project was to develop a proven methodology that would identify a strategic response to the technology in a large organisation and the second part was to undertake the strategic development

A team of CSA members specialists in various areas of text processing, grouped together to undertake the joint project which had three major objectives

- "To establish a high level of expertise in text processing within the UK computing services industry"
- To provide information to UK equipment manufacturers to assist them in developing products to meet the growing market'
- 'To illustrate to UK industry how to take advantage of the technology

The ten companies who agreed to be guinea pigs for Part II of the project also footed over 60% of the total cost, which was £250 000 the rest being funded from the DoI This part of the project offered an in-depth analysis of user requirements and the development of appropriate systems for the next five years The time span is important as the length allows a comment to be made on real developments, and not piecemeal, or ad hoc, situations Because of the time span involved, it has also been possible to justify the cost of the majority of developments that occurred within the ten user organisations The organisations that participated represent a good spread of industry and the public sector

Abbey Life Insurance Co
British Institute of Management
British Leyland Cars
Citibank (UK)
Knight Frank & Rutley
Metal Box
Paymaster General's Office
Royal London Mutual Insurance Co
Dalgety Spillers
Thames Water Authority

Relationships

When asked about moving along the path of implementing new technology these organisations were consistent in their comments 'Gain experience now, and don't sit on the sidelines" "The greater your experience, the greater the advantages" Certainly none of the companies involved in the project considered moratoriums a productive, or forward thinking, attitude to adopt

The consolidation of the findings of the Part II project will not be complete until September of this year, however, the joint study has been able to make certain conclusions which are of value to concerns considering introducing micro technology

Findings

It is worth commenting briefly on some of the consistent findings within the ten organisations

The results of the studies did not indicate that the introduction of micro technology was likely to result in massive staff savings Major recommendations often hinged on the ability provided by the installations to expand the business or to make the production of text for example, more responsive to the needs of the business The studies did not foresee lots of people displaced through technology and it was felt that productivity gains would offset staff increases This would appear to endorse the thinking behind the Treasury projections mentioned earlier

The project also confirmed that the growth of micro electronics was piecemeal at the moment, and that most companies had not given enough thought to long term integration of systems or had equated this with short-term investment costs Such a piecemeal approach did not allow companies to reap the real benefits available from text processing – for example the better executive productivity and ability that is possible and which could be harnessed to meet competition head-on Companies should therefore develop an overall text processing or technology plan – then set out to achieve this stage by stage as the technology allows

None of the plans put forward during the CSA/DoI studies represented a capital expenditure of more than £750 per office employee, therefore, the excuses used by many companies that high capital costs are a deterrent to technological growth seem to be damp squibs as far as the joint report indicates

A final, general conclusion, was the comment that the random mix of suppliers would be difficult to incorporate later in linked communicating systems, and a clear purchasing policy was essential for a company if it were to reap the full benefits of micro technology

There must be many an airline in the world that does not regret using a word processor as its starting point and seeing the introduction of that as its ultimate objective, rather than pursuing the eventual goal of say retrieval of information to aid customer requirements

The pleasing aspect of such a joint approach such as this CSA/DoI project is that it is an attempt to achieve some overall UK experience Pulling groups of consultants together unselfishly to share their skills such as the CSA consortium has done is more analogous to the Japanese approach to problem-solving and experience sharing than UK oriented Also, this type of project does allow a liaison between users-manufacturers-software

The partial funding of such a project by the DoI is a step in the right direction and should be closely followed by more detailed studies of the social and human implications within the user organisations as a result of introducing sophisticated technology This would go some way to relieving the qualms of the cursory sample of organisations referred to earlier

It may also save the UK from falling into the economic hell we will create through being devils to ourselves ■

Linda King Taylor has specialised in management-labour relations, is the author of books on the subject, and is at present co-writing a book (to be published by McGraw Hill) with Edward de Bono whose lateral thinking has exercised a profound influence on a new generation of innovators

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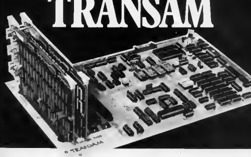

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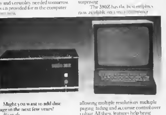

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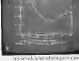

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[illegible] upper and lower case text and diagrams.

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Bimonthly Series

A PRACTICAL EXAMPLE

A CHEQUEBOOK PROGRAM

Dr Martin Beer, an editorial advisor to Computer Age is at the Computer Laboratory, the University of Liverpool

So far, in this series of articles I have discussed how programs are written in a structured way. Now I want to do something slightly different and discuss how a real program was developed to perform what for me is a very useful task, keeping track of the money going in and out of my current bank account. I have for some time, in fact been using a fairly simple balancing program written in BASIC, to do this but now wanted to keep track of the number of and cash involved in, various transactions under different headings. Modifying the BASIC program to do this would have taken longer than rewriting the program from scratch. Also even further minor modifications were likely to be difficult, and expensive, both in time and effort to implement and test thoroughly enough to have confidence in the final results produced by the program. I therefore decided to rewrite the program from scratch.

A similar program written in Pascal which provides roughly the same facilities as my original program appeared in a recent edition of BYTE (1) and provided the impetus to develop the new version to run on the APPLE using Pascal. It is most likely with a program of this sort, that the detailed records required will change as much in the future as it has done in the past. The program must therefore be modular so that it can be adapted quickly and easily as required.

The basic program is very simple. Some variables must be initialised and the initial value of the balance read in. Then each transaction must be processed until the End of Run transaction is encountered. The summary report is displayed and the program is then terminated. Figure 1 shows the main program.

It is also necessary to define the main data items required at this stage. These will be used by the procedures called by the main program, but must be declared globally to ensure that they are available whenever they are needed. Only those variables which are required to define the problem need be considered at this time, temporary and working variables can be declared within the procedures which require them. Table 1 gives a list of the globally declared variables, with their associated types, and their use within the program.

```
BEGIN
    DONE - FALSE,
    INITIALISE
    READBALANCE
    REPEAT
        PROCESSTRANS (DONE)
    UNTIL DONE
    SUMMARISE
END
```

Fig. 1 The main Chequebook Program

DONE is a boolean flag which signals to the main program that a command to end the run has been recognised and accepted. When it is returned TRUE the program falls out of the REPEAT Loop and displays the summary.

The current balance is held in the variable, BALANCE. The initial value is requested, and stored by the procedure READBALANCE. It is then updated as each transaction is processed and displayed ready for the next transaction to be entered. The variable INITBALANCE is set to the same value as BALANCE in READBALANCE and is used to display that value as part of the summary. This is useful for checking the results, since all the required information is then available.

VARIABLE	TYPE	USE
BALANCE	REAL	The current balance
INITBALANCE	REAL	The initial balance
DONE	BOOLEAN	Is the program finished?
NOCREDIT	INTEGER	Number of transactions in each category recognised
NODEBIT		
NOINTEREST		
NOREGPAY		
NOSALARY		
TOTCREDIT	REAL	totals for transactions in each category recognised
TOTDEBIT		
TOTINTEREST		
TOTREGPAY		
TOTSALARY		

Table 1 Global variables used by the chequebook program

The number of transactions in each category and their totals are stored in the other global variables.

The main program calls a number of subsidiary routines which must now be defined. INITIALISE is the simplest of these. All it needs to do is to set the summary variables to zero. No further procedures or local variables are required.

The next procedure to consider is READBALANCE. Here it is necessary to clear the screen and print the heading. The user is then prompted for the initial balance. Numbers are terminated by pressing the RETURN KEY (hence the READLN instruction). The user is then requested to confirm that the value he entered is correct. To confirm this and continue with the program one key is pressed the 'Y' key. If any other key is pressed the program asks for the initial balance again. A local variable is required to store the character entered as confirmation of the balance entered.

PROCESSTRANS is the procedure which does most of the work. After displaying the current balance at the top of the screen a prompt line asks what type of transaction is to be processed. This is entered as a single character (again NO RETURN is needed).

If ESCAPE (ASCII code 27) is pressed, another routine ENDOFRUN is entered. This routine must set the boolean parameter FINISHED to TRUE if the user confirms that he wishes to leave the program, otherwise it sets it to FALSE and returns to the main program. If any other key is pressed it is checked to ensure that it is a legal command, and then the transaction can be processed using a CASE statement.

Pascal provides a simple method of testing whether a command is legal using the SET data type. If a set of the recognised single character commands is constructed (the first assignment statement in the procedure does this) the character can be tested to see whether it is included in the set. Otherwise the procedure returns to the main program without doing anything.

The code required to handle each type

of transaction is included separately in the CASE statement The procedure SETVALUE is defined so as to read the value of the current transaction and to ask the user to confirm it This value must be placed in a temporary storage location since it must be added to the running total for that type of transaction and to update the current balance Once the balance has been updated control is returned to the main program so that the next transaction can be processed

The procedure SUMMARISE displays the current balance the initial balance and a summary of the number of transactions processed in each category and their total value The procedure DISPLAY BALANCE is shared with the PROCESSTRANS to avoid the necessity of repeating code and to maintain a standard display format for the current balance This is important to maintain a house style which will be much appreciated by the end user

It is very easy to add further categories to the program Once the extra code has been added to the CASE statement in PROCESSTRANS the extra command letter must be added to the assignment to OPTIONSET The prompt should also be changed at this stage to remind you of the changes you have made Additional global variables are required to hold the number of transactions and the total of all transactions in that category processed Finally the procedures INITIALISE and SUMMARISE must be altered to display the summary information correctly

If your computer has file handling facilities it would be possible to store the closing balance on a file, and recover it at the start of the next run The procedures READBALANCE and SUMMARISE must be altered to support this

'It is very easy to add further categories to the program.'

I hope that this article shows how a program is developed in a systematic way Although written in Pascal the principles are the same when using any other programming languages It is very important to design the program in such a way that it performs in the way that the user expects This is not just the main design of the program but also both input and output These are the immediate user interface and should always be designed with great care It is always annoying if the input is not standardised In this case all numbers are terminated by "RETURN" and all commands are single characters, which are not followed by "RETURN" Before anything is actually changed the program always requests confirmation from the user that the information entered is correct This allows the user to check the information he has entered and to cancel it if he has made a mistake ■

NOTE

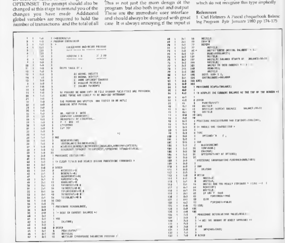
The main program listing was produced directly by the UCSD PASCAL Compiler running on an APPLE II Microcomputer Since my APPLE does not, at present support lower case input from the keyboard the whole program was written using upper-case letters only To maintain readability I have used upper-case letters only in all references to parts of the program in the article and other figures The usual convention is to use both upper and lower case letters

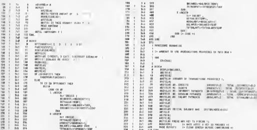
Lower-case letters should be used if your computer and peripherals can support it, since lower-case letters make the program text is then far more readable

I have taken some care to use, as far as possible only those features which are available in all versions of Pascal I have used the UCSD Pascal Data type STRING which would have to be declared explicitly when using compilers which do not recognise this type implicitly

References

1 Carl Helmers A Pascal chequebook Balancing Program Byte January 1980 pp 174-175





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IVERSON'S LANGUAGE

Lists and One-Argument Functions

The first article in the APL (A Programming Language) series appeared in Issue 6
The micro equipment needed is ●a Z-80 CP/M (tm) system, minimum memory 48K bytes, one floppy (5 or 8") ●VDU or hardcopy terminal ●copy of APL/V80 ●copy of CP/M operating system

The preceding article dealt with scalars or single items In APL, lists and tables are manipulated with equal facility A list is more frequently called a vector in APL and we will adhere to this usage

A vector is formed by entering a sequence of numbers separated by one or more spaces thus

```
      3 4.5 2.7 1.9
3 4.5 2.7 1.9
```

Assignment is no different for vectors.

```
      X←1 9 7 5
```

Using primitives is straightforward For example

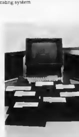
```
      3+1 9 7 5
4 12 10 8
```

Try a few more examples.

```
      4×5 6 7 8
20 24 28 32
      9÷1 2 3
9 4.5 3
      5-3 4 5 6
2 1 0 ¯1
      3 4 5 6 +7
10 11 12 13
```

Clearly the single element is applied to each element of the list

⌈ and ⌊ (maximum and minimum) were introduced earlier Verify that you follow



these examples If necessary, key in a few examples of your own.

```
      3 9 6 5 ⌈6
6 9 6 6
      3*1 2 3 4
3 9 27 81

      1 2 3 4*2
1 4 9 16
```

A more difficult example (recall the right-to-left rule)

```
      7⌊3 8 5 1 9⌈4
4 7 5 4 7
```

There is a common psychological difficulty here In the above example 3 8 5 1 9 is a single entity just like 4 on the right of ⌈ However, although you may appreciate this rationally you may find yourself automatically performing the result of

```
      3 8 5 1 9⌈4
4 8 5 4 9
```

on 9 and 4 only This should be only a temporary difficulty (if it is experienced in any degree) If necessary enclose vectors in parentheses – no harm will result

What if we have a vector as each argument?

Consider the following examples (and enter them)

```
      4 5 6⌈6 5 4
6 5 6
      2 3 4*2 3 4
4 27 256
      7 8 9÷1 2 3
7 4 3
```

Here, corresponding elements are combined as in the scheme below

```
      3 8 9-4 5 3


¯1 3 6
```

```
APL:      ←        APL:      ⌊            ⌈            ÷  ¨           APL:      ← × ÷ ¯
ASCII:    _        ASCII:    D(or min)    S(or max)    %  `(grave)    ASCII:    _ # % ~

       APL:      ρ(monadic)  ρ(dyadic)  IN ASCII MODE shape OR reshape must
       ASCII:    shape       reshape    be used as appropriate or "SYNTAX
                                        ERROR" will be returned
```

What if we attempt to combine two vectors with different lengths (numbers of elements)? Consider

```
          3 4+9 8 7
    LENGTH ERROR
          3 4+9 8 7
            ^
```

APL returns "LENGTH ERROR

CONFORMABILITY RULE

The primitive functions used so far are called scalar dyadic functions Let us recall these terms

*scalar a single element applied as a description it means acts like scalar, which in turn implies perhaps tortuously that it acts on a component by component basis

*dyadic possesses two arguments

The conformability rule for scalar dyadic functions is

*The arguments should have the same number of elements whereupon the result is applied by combining corresponding components or one argument comprises one element whereupon the single element is combined with each component of the other argument

Now try the following examples They illustrate how fairly difficult problems can be solved very easily using APL

EXERCISE

1 Six grades of employee have salaries as follows

```
SALARY←4100 4300 4600 5000 5500 5500
```

Assign to the variable NEWSAL the new salaries if all grades are given a 15% increase

2 In the last example assign to the variable ADJSAL the salaries if the increase is 15% except that no salary may be less than £5 000 p a nor greater than £6 000 p a

3 Instead of an across-the-board increase of 15%, each salary grade is increased respectively by the following percentages

```
  10 12 14 16 18 20
```

Assign to DIFFSAL the new figures in this case

4 In addition to the increase received under the 'DIFFSAL option each employee receives a single payment of £120 What are the salaries now? Assign the result in ENDSAL

5 What are the increases for each employee if their salaries are ENDSAL as a percentage of SALARY?

COUNTING THE NUMBER OF ELEMENTS

The number of elements of a vector is obtained using the primitive function ρ, thus

```
          X
    1 2 3 4 5
          ρX
    5
```

The primitive is different from those we have seen before in two respects

*It is a one-argument (monadic) function Hitherto all functions have been dyadic,

*The result has a different number of elements from the argument Scalar primitives produce a result with the same number of elements as the arguments – ie they "preserve length The slight exception of a single argument is more usefully regarded as the single argument "extending itself' in agreement with its fellow argument)

There is a curious point in connection with the shape of a scalar Enter

```
          ρ1 2
    2
          ρ1
```

(APL returns a blank)

The shape of a scalar is not 1 as you may reasonably expect but nothing – more accurately the shape is the null vector There is good reason for this, but for the present just regard it as a curiousity

EXCERCISE

1 X and Y are both vectors How can we check that X+Y will work (ie not produce LENGTH ERROR when entered) before entering it?

REPEATING THE ELEMENTS OF A LIST

A list may be extended by using ρ dyadically whereupon it is termed reshape Enter

```
          3ρ1
    1 1 1
          4ρ1 2
    1 2 1 2
          X←1 2 3
          ρX
    3
          Y←6ρX
          Y
    1 2 3 1 2 3
          ρY
    6
          2ρX
    1 2
```

Reshape repeats a list according to the left argument: if the left argument is smaller than the length of the right argument, dyadic ρ has the effect of truncating the list To summarise

*Dyadic ρ, called reshape applied to a list repeats the list or truncates it so that the result has the number of elements specified by the left argument

Incidentally, we use the terms "shape" and "length' synonymously in APL

EXERCISE

1 X and Y are vectors Write down an expression adding X to Y, except that if Y has the wrong number of elements it is extended or truncated as necessary

SELECTING FROM LISTS INDEXING

APL allows us to pick out specific elements of a list by indexing We first enter a few examples before discussing the general rules

```
          X←7 9 4 3 8 6
          Y←1 8 10 3 9
          X[4 3 6 1 5 2]
    3 4 6 7 8 9
          X[1]
    7
          X[1 2 3]⌈Y[3 2 1]
    10 9 4
          Y[1 1 1 2 2 2]
    1 1 1 8 8 8
```

The numbers in brackets are addresses signifying which members are selected, the order of selection occurring in the order specified by the index set The numbers in brackets are termed the index set so that (4 3 6 1 5 2) is the index set in the first example above

*The index set may comprise any arrangement, as desired, of the integers 1, 2, N, where N is the shape of the vector

*The shape of the result is the shape of the index set;

*The result is a vector comprising the elements of the vector in the order indicated by the index set

What if we do not follow these rules? Well, let us try

```
          X←3 6 9 4 5 6
          ρX
    6
          X[7]
    INDEX ERROR
          X[7]
```

APL:	ρ	X	APL:	←XY	APL:	←	APL:	←A-Z
ASCII:	shape	x	ASCII:	_xy	ASCII:	_	ASCII:	_a-z

```
        ^
      X[1.3]
DOMAIN ERROR
      X[1.3]
        ^
```

– we got an error "INDEX ERROR" is probably easy enough – we have attempted to access a non-existent but conceivable index (ie a positive integer) "DOMAIN ERROR" signifies that the proposed index of 1 3 can never be an index of any vector because it does not lie in the "domain" of positive integers

Constants may be indexed as well as variables thus is sometimes useful For example

```
      11 12 13 14[2 4 3]
12 14 13
```

The 2nd, 4th and 3rd items are selected

EXCERCISE

1 In a competition, corresponding pairs of individuals compete from teams A and B If the points awarded to team A and team B are given by

```
      TEAMA
93 79 85 46 84 45
      TEAMB
48 49 99 73 48 44
```

Write down the APL expression giving the list of victors' points

APL Series

In the next article we introduce the primitive function '>' meaning greater than Enter

```
      TEAMA>TEAMB
```

The result is a vector comprising 1's and 0's Try to anticipate the next article by interpreting this result

2 The primitive function '?' called "deal" produces a rearrangement of the integers so that 4?5 for example produces a vector of length 4 comprising a selection of 1 2 3 4 5 without repeats

Produce a random arrangement of the integers 11 to 20 without repeats (Hint The primitive '+' is needed, '?' by itself is not sufficient)

3 Enter variables

```
INDEX←10?10
X←95 52 73 86 49 88 37 53 65 15
```

(a) check that ⍴ X is 10

(b) enter X[INDEX] and interpret the result

4 A business has 6 lines with a selling price (SP) in £'s and sales (SALES) in thousands given by

```
SP←3.5 4.6 1.32 7.35 5.35 8.63
SALES←20 8 50 2 3 5
```

Obtain the income from each line,

(a) in £'s X 1000

(b) in £'s

5 In the preceding example the margin (%) on each product is given by the vector

```
      MARGIN←3 8 2 20 15 8
```

Construct a vector COST, giving the cost price of each line, and a vector TOTALCOST giving the total cost of sales The profit is the difference between the cost and the income Write this down

6 In the preceding example there is a fixed cost of £15 000 p a If this is allocated equally to each line (ie £2 500 p a each) write down the net profit vector – call it NETPROF

Now enter

```
      NETPROF>0
```

What does this mean?

7 Enter an APL expression which repeats the number 999 50 times

8 Enter)VARS Find the shape of each variable listed

■ *To be continued*

Dr Alan Pearman is the principal of A P Ltd which has its own purpose designed micro APL system the MAPLE

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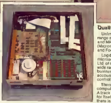

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SPECIAL INTEREST

Language **Artificial Intelligence** **Bob Welham**

The author explains some of the concepts involved in using PROLOG a computer programming language based on predicate logic Bob Welham is formerly of the Department of Artifical Intelligence, Edinburgh University

PROLOG

In this article I hope to introduce the reader to some of the basic ideas behind the use of predicate logic as a practical computer programming language The approach will not be that of a logician but rather that of a computer programmer Already there has been widespread use of predicate logic based programming languages within the field of Artifical Intelligence The language PROLOG (PROgramming in LOGic), originally developed at the University of Aix — Marseilles in France by Alain Colmeraur and colleagues has been implemented now in numerous establishments, in particular at the Department of Artificial Intelligence at Edinburgh University and at the Department of Computing and Control at Imperial College London In subsequent articles we will look at two programs which have been writen at Edinburgh in PROLOG, the first to solve problems in plane Euclidean geometry and the second to solve symbolic algebraic equations

It will be most interesting to see during the coming years the extent to which commercially produced software is influenced by software developed by researchers into Artificial Intelligence Techniques such as the calling of procedures by pattern matching and built-in backtracking search algorithms must surely prove to be useful

Exciting recent developments such as the implementation of PROLOG interpreters on minicomputers and microcomputers should lead sooner or later to its common use, at first within the fields of education and personal computation but perhaps later within the commercial and industrial sectors

The Language PROLOG

Let us now look at the structure of a program written in PROLOG A program consists of a number of *clauses* and each clause may be thought of as a *procedure* within the program and consisting of a *procedure head* and a *procedure body* As an example let us consider the following clause

$$\underbrace{\underline{\texttt{woman}}\ (X)}_{\texttt{procedure head}} \leftarrow \underbrace{\underline{\texttt{human}}\ (X)\quad \underline{\texttt{female}}\ (X)}_{\texttt{procedure body}}$$

The backwards arrow symbol '←' which separates the procedure head from the procedure body is to be read as "if" or "is implied by" Thus we can interpret clause (1) as stating that "X is a woman if X is human and X is female" The procedure body is to be interpreted as a set of procedure calls The conventional syntax is that these procedure calls are separated by commas and that the end of the clause is designated by a full stop There can be any number of procedure calls within a procedure body An interesting case is when the number is zero as for example in the clause

```
female (kathy) ←
```

This clause states that *kathy* is female and the absence of any procedure calls within the procedure body means that the program may accept this as a fact, that is, that it is given as data Note that in clause (1) the symbol 'X' is a *variable* which will take on different values for different calls of the procedure whereas in clause (2) *kathy* is a *constant* The convention is for variables to be denoted by names beginning with a capital letter and for constants to be denoted by names beginning with a lower case letter It will be clear that a database will be represented in PROLOG by a set of clauses of the type shown in (2), that is, by procedures which have no procedure body

The arguments which follow in brackets after each procedure name may be more complicated than a single variable or constant Structured items may be built up using *functors*, for example the functor *join* in the following clause

```
line (join(X Y)) ← point (X) point (Y) distinct (X Y)
```

This clause states that if X and Y are two distinct points then there is an object called *join* (X, Y) which is a line Arbitrarily complex *terms* may be built up using functors, variables and constants in a consistent way for example the term *intersection* (*join* (X, Y) *join* (P, Q)) might be used to denote the intersection point of the two lines XY and PQ Note that a constant is really a functor which takes zero arguments

Functors may also be defined and used in infix notation rather than the prefix notation of *join* above For example the functor '+' indicating addition may be used to construct items such as A + B which has the same meaning as +(A B) but looks much neater

The guts of a PROLOG program will usually consist of clauses of the type shown in (1) that is of clauses which have a procedure head and one or more procedure calls within the procedure body The general form of such a clause is

$$P \leftarrow Q_1,\ Q_2,\ \ldots\ ,\ Q_n$$

We may think of this clause as stating that wherever we need to solve P, then we can do so by solving all of the sub-problems Q_1, Q_2, and Q_n which occur within the procedure body It thus gives us a method of breaking down a problem into more easily solved sub-problems

There is one other type of clause in PROLOG, and that is a clause such as

```
← woman (X), beautiful (X)        (1)
```

This type of clause with no procedure head and consisting only of a procedure body, is called a *goal statement* It is a set of procedure calls and it is this type of clause which will activate a PROLOG program Thus if I input clause (1) to a PROLOG system, I am asking the system to find a value for X such that the procedure calls *woman* (X) and *beautiful* (X) will both succeed At any stage during a PROLOG computation, there will be a *current set of goals* that is, of procedure calls waiting for execution To execute a procedure call, PROLOG must first find a clause with a procedure head which *matches* the procedure call.

Pattern Matching

This idea of a procedure call matching a procedure head, that is of *pattern directed invocation of procedures*, is fundamental to PROLOG and requires further explanation

The formal rules for whether or not a procedure call and a procedure head will match are rather complicated to express, and we will try here to demonstate the idea of matching by giving examples Suppose for instance that we have a procedure call *woman* (X) and a procedure *woman* (*susan*) ← within our program Then here we can *match* the procedure call with the procedure head by choosing the value *susan* for the variable X. Now in general a procedure call will be only one of a current set of procedure calls awaiting execution and if in the case above *woman* (X) was an element of the current set {*woman* (X), beautiful (X)} then the X within the procedure call *beautiful* (X) would also have to take on the value *susan* before the computation could proceed. In general, if one procedure call within the current set of procedure calls is successfully executed by choosing certain values for the variables occurring within it then other occurrences of those same variables within the other procedure calls within the current set must also take on those same values before the next procedure call from within the set is executed.

Thus in the above example, the procedure call *woman* (X) succeeds by X taking on the value *susan*. The procedure call woman (X) then is deleted from the current set and, moreover, the procedure call *beautiful* (X) is changed to the procedure call *beautiful (susan)*. What has happened is that, given the problem of finding X such that X is both a woman and beautiful PROLOG has solved the first half of the problem by finding the value *susan* for X thus leaving the problem of then proving that susan is beautiful. PROLOG will then proceed by looking for procedures whose head can be matched with *beautiful (susan)*. Suppose that within the program there is the procedure 2

```
beautiful (X) ← blonde (X), browneyes (X)
```

Then again we have a match between the procedure call *beautiful (susan)* and the procedure head *beautiful* (X) by X taking on the value *susan*. But this time the variable X occurred within the procedure head not within the procedure call, so we see that the matching process can give values to variables in both. What happens now is that each X within the procedure body also takes on the value *susan*. The matched procedure call *beautiful (susan)* is then replaced within the current set of goals by the body of the matched procedure head that is, in this case, by the two new goals *blonde (susan)* and *browneyes (susan)*. Thus procedure (2), which states that if X is blonde and X has brown eyes then X is beautiful, has been used to replace the goal *beautiful (susan)* by the two goals *blonde (susan)* and *browneyes (susan)*.

In the general case a match between a procedure call and a procedure head is made by finding values for all the variables occurring within both such that when these variables are replaced by these values the procedure call and the procedure head become identical. In theory there will be many different ways of achieving this but in practice what we require are those values of the variables which still leave the matched arguments of the procedure call and the procedure head as free as possible. To illustrate this consider a procedure call p(a f(Z)) and a procedure head p(X, Y). Now to match these we can choose the values X = a, Y = f(a) and Z = a to give both the procedure call and the procedure head the form p(a, f(a)). But you will notice that there is really no need to give Z the value a we can just choose the values X = a and Y = f(Z) to give the common form p(a f(Z)) which leaves the variable Z still free thus keeping our options open for further computation. Luckily, there always exists a unique *most general match* between a procedure call and a procedure head which will match and this is the one that PROLOG utilises.

Backtracking

In general there will be more than one procedure head which will match a procedure call. For a simple example suppose we have a database which contains both *woman (susan)*← and *woman (alice)*←. Then when it tries to execute a procedure call *woman* (X), PROLOG is faced with a choice of values for X. Suppose it first chooses *susan* and then later finds that this was the wrong choice, that is that some other goal within the current set did not succeed with the value *susan* for X. Then what happens is that PROLOG *backtracks* to the choice point where it chose *susan* for X and now instead tries the value *alice*. It repeats this backtracking as many times as necessary until it finds a value for X which enables the other goals to succeed. This necessity to choose means that PROLOG is a *non-deterministic* programming language. Each *implementation* of PROLOG will of course be deterministic in the sense that these choices will be made in a predetermined manner. The standard order of choice of procedure heads which match a procedure call is the order in which they appear with the program. Thus suppose the programmer had written his program in the order

```
woman (susan) ←

woman (alice) ←

woman (X) ← human (X), female (X).
```

Then when trying to execute a procedure call *woman* (Y) PROLOG will first try the value for *susan*, then the value *alice* and then if both of these values cause other goals to fail it will backtrack and try the third clause and replace the goal *woman* (Y) with the two goals *human* (Y) and *female* (Y).

The other type of choice which PROLOG has to make is that of choosing which procedure call from within the current set to try to execute. Again the standard way in which this choice is implemented is for PROLOG to execute the procedure calls in the order in which they appear within the program that is from left to right. Thus, if I input the goal statement ←*woman* (X) *beautiful* (X), then PROLOG will first execute *woman* (X) and if successful will then execute *beautiful* (X).

A Worked Example

Let us define a *list* as either the constant *nil* (representing an empty list) or an item of the form X L where " " is an infix functor. X is said then to be the *head* of the list and L the *tail* of the list. Now consider the PROLOG program

```
concatenate (nil, X, X) ←                                    A
concatenate (U L, M, U N) ← concatenate (L, M, N)            B
```

We require concatenate (P Q R) to mean that the list R is that list which is formed by concatenating or stringing together the lists P and Q. Clause (A) then states that if you concatenate any list X to the empty list *nil* then you get the same list X. Clause (B) states that if you want to concatenate a list U L and a list M then you will get a list U N where N is the result of concatenating the list L and the list M.

Let us now enter the goal statement

```
←concatenate (1 2 nil, 3 nil, W)                             C
```

This is asking the program to find a value for W such that W is the concatenation of the lists 1 2 *nil* and 3 *nil*. Now the single procedure call in the goal statement (C) will not match the procedure head of (A) since 1 2 *nil* will not match *nil*. *Therefore we must try clause (B) and here we get a match with the values* U = 1, L = 2 *nil*, M = 3 *nil* and W = 1 N. So we know that W is of the form 1 N for some value of N and the computation proceeds with the current goal now *concatenate* (2 *nil* 3 *nil*, N). This goal again will not match the head of (A) but will match the head of (B) with the values this time

```
U = 2, L = nil, M = 3 nil and N = 2 N'
```

So we now know that N is of the form 2 N' and therefore that W = 1 N is of the form 1 2 N' for some N'. The current goal has now become concatenate (*nil* 3 *nil*, N') and thus now matches (A) giving the value 3 *nil* to N'. Thus the original goal statement has now succeeded with the value W = 1 2 3 *nil* which is as we require.

Summary

We have illustrated some of the ideas embodied within PROLOG and, we hope shown that it is an elegant and practical high level programming language. In future articles in this series we will look at some programs that have actually been written in PROLOG and we trust that this will help to clarify any obscure points.

Further Reeding

We have presented in this article only a brief introduction to the techniques of programming in logic. For a comprehensive treatise on the subject the reader is referred to the excellent book *Logic for Problem Solving* by Robert Kowalski published by North Holland as one of their series of books on Artificial Intelligence. Dr Kowalski is a Reader at the Department of Computing and Control at Imperial College, London, and formerly of the Department of Artificial Intelligence Edinburgh University. ■

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DEMONSTRATION TWO

[illegible] magazine [illegible] happened [illegible] Demonstration One [illegible]

First the answer to May s problem This was to write a programme for finding the H C F of two numbers The original Euclidean algorithm required you to divide the larger by the smaller retaining only the remainder and the smaller from this division Thus is then iterated until the two numbers are the same Thus supplies the answer it is slow because division is a slow process An alternative is to subtract the two numbers instead stopping when the two are equal For example

```
: HCF BEGIN DUP ROT   ABS 2DUP - END
  DROP ; .
```

To run this you type A B HCF where A and B are the two numbers The loop ends when the two remaining numbers are equal that is when the answer to the test = is true which puts a 1 on the stack If they are unequal the test puts a 0 on the stack so that END seeing a 0, takes the programme back to BEGIN

If you have no version of FORTH available but you can get your hands on a Hewlett Packard programmable calculator you can try a modification of the HCF programme on it and get some practice with high stack handling at the same time

The HP calculator has a 4-deep stack and has available commands similar to 'DUP' ROT and 'SWAP' For example 6 ENTER gives a 6 in the display (top of the stack) and another in the next-to-top So ENTER can be used like DUP SWAP is represented by a key marked X⇄Y (X is top Y is second) A key labelled R↓ will rotate all four stack entries putting the top to the bottom and moving all the others up So here is HCF on the **HP 29C CALCULATOR** (the others are similar)

```
LBL 1     (LABELS THE START)
R/S       (KEY IN THE FIRST NUMBER)
R/S       (KEY IN THE NEXT NUMBER)
LBL 2     (EQUIVALENT to BEGIN )
ENTER     (LIKE DUP )
R↓        (ROTATES TOP TO BOTTOM)
-         (SUBTRACTS TOP FROM NEXT)
ABS       (GIVES ABSOLUTE VALUE)
X⇄Y       (EQUIVALENT TO 'SWAP )
R↓
X=Y       (TEST FOR END OF LOOP)
RTN       (EQUIVALENT TO END')
GTO 2     (LOOP IF NOT TRUE)
```

This is the state of the stack after each operation Suppose the two numbers are 175 and 50

```
R/S(0 0 0 175)R/S(0 0 175 50)
ENTER(0 175 50 50)R↓(50 0 175 50)-
ABS(0 50 0 125)X⇄Y(0 50 125 0)
R↓(0 0 50 125)
```

– and now we have a pair of numbers to serve for the next time round The stack will finish up like this (0 0 25 25) The test will be true and the programme will stop with 25 on display

The FORTH programme is similar but not precisely so For example here s what happens to the stack in FORTH HCF –

```
(175 50)DUP(175 50 50)ROT(50 50 175)
-ABS(50 125)
```

And we are ready to go round again We have to do a 2DUP' before the test for equality since the test removes the pair of numbers it tests HP calculators are useful for learning to handle the stack in FORTH They will also perform very sophisticated calculations but obviously much more slowly than a microcomputer

We now continue the **Staidist** Demo First I want to improve on last month s NEGEX demo This involves ironing out a bug in the rnd no generator The 13th Bin is low This is because there is a slight periodicity caused by the fact that 13 numbers are added together The error is largely removed by neglecting successes that occur on an odd try after the start That is I throw my die for a success but if it occurs on an odd try I ignore it * You may think it is cheating to manipulate a random no like this but it is only the inverse of the process of cleaning up a signal by removing the noise I remove the odd tries by anding the loop counter with 1 The modified programme follows

```
STATDIST INSTRUCTIONS
+++++++++++++++++++++
>BLOAD FORTH M/C ROUTINES 2
>BLOAD FORTH STATDIST A 4
>BLOAD FORTH NEGEX 5 / OR OTHER EXAMPLE
>BRUN FORTH
4 LOAD 5 LOAD
TO RUN NEGEX, EXAMPLE, 200 T   20 SAMPLE
2000 NEGEX    FOR  MORE  2000 NEGEX  FOR
MORE ACCURACY, 30 SAMPLE
DOS>BLOAD FORTH FERMI 3 >CALL8192
4 LOAD 3 LOAD
TO RUN FERMI -EXAMPLE, 200 T ' 8 SAMPLE
20000 FERMI   FOR MORE, 20000 FERMI ETC.
DOS>BLOAD FORTH POISSON 5   >CALL8192
4 LOAD 5 LOAD
TO RUN POISSON  EXAMPLE 25 GOES 4 MINS
2 SAMPLE 600 POISSON  FOR MORE, 600
POISSON  FOR MORE ACCURACY INCREASE GOES
PER MIN. TO DEGENERATE, TAKE E 6 8 GOES
4 MINS

( SCREEN 5. NEGEX DISTRIBUTION)
( HOW LONG DO YOU HAVE TO WAIT FOR SUCC
ESS?)
```

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*I treat it as a success by returning to the start but I don t record it

```
: NEGEY @
  DO "8 @
   DO
    RANDOM RPR       ( SETS RANDOM NUMBER)
     T @ >                 ( SUCCESSFUL?)
     IF                      ( YES BUT )
      I DUP 1 AND            ( REJECT
      IF DROP              ( ODD TRIES
       ELSE 5 @            ( SCALE IT
        X I DUP + ( INC ( SCORE A HIT )
        Y I DUP + > @           ( GET IT )
        A C@      ( DECIDE SAMPLE SIZE )
        PLOT                  ( PLOT IT )
      THEN LEAVE             AND HOP IT)
     THEN ( IF YOU'RE HERE YOU FAILED
   LOOP                  SO TRY AGAIN )
  LOOP ;
;S

( SCREEN 3  FERMI DISTRIBUTION )
(   ************************    )

: FERMI @
      DO 5A @
        DO RANDOM RPR T @    ( SUCCESS?)
          IF I DUP 1 AND ( YES BUT RE-)
            IF DROP    ( JECT ODD ONES )
              ELSE 5 @ RANDOM RPR
              3 @ 4     PLOT ( PLOT AND)
            THEN LEAVE ( Y-COORD  AND )
                      ( EXIT INNER LOOP )
          THEN ( JUMP HERE IF FAILURE )
        LOOP     ( AND GO ROUND AGAIN. )
      LOOP ;
```

I will try to give an analogue of this Suppose you had a number of egg boxes laid out in numbered array with each egg hole numbered, say 1 to 6 within each box You stop at the first box and throw a die having decided on a number to constitute a success If you are successful you throw again to decide which egg hole to put an egg in and then go back and start again **If you fail at any box you pass on to

FORTH

the next (only starting again on a success) If you already have an egg in the indicated hole you do nothing and return to the first box again It is this last trick that gives rise to the Fermi Distribution

After a time you find the early boxes are full, with a tail-off in the higher numbered boxes Not being allowed to put an egg in an occupied hole is called the Pauli Exclusion Principle

The actual case in which this arises in Physics is in connection with electrons in solids such as metals and semiconductors *In fact it is this particular distribution that makes possible the construction of the devices which go to make a modern computer* Anyway the distribution itself is interesting

As a tail piece I read a recent survey of languages for micros in I E E E Computer in which is said that FORTH has poor readability because of its reverse polish look Fact is that all languages have poor readability unless you have learned to read them When computer languages become as readable as our everyday language then I suspect they will be just as imprecise

As an encouraging note to end on Sinar Agritec won the NRDC Competition for the industrial application of a microprocessor They programmed in FORTH and claimed that it speeded development time (see photograph)

As a computer language FORTH enters its second decade the Forth Interest Group announces the expansion of its newsletter FORTH DIMENSIONS Now in a bound journal form this newsletter offers FORTH related events from around the world with technical and historical articles

A special technical issue will appear in July on the CASE statement This issue concludes a competition conducted over the past five months, on this extension for the language Regular features include regional meeting notices Standard Team activities implementation availability technical articles correspondence and vendor announcements

FORTH was created in 1969 by Mr Charles Moore as a multi-level computer language with support for compilation an operating system mass storage interactive testing and machine language It is in use around the world for such diverse applications as observatory automation graphics display database management and text processing The Forth Interest Group has published FORTH DIMENSIONS for two years thus providing an international forum for educational and professional needs Membership is currently over one thousand

Membership and a *six issue* subscription to FORTH DIMENSIONS are $12 in USA Canada and Mexico overseas by air is $15 Issues 1 through 6 are available as a *set* for $6 (domestic) or $7 overseas New members will automatically receive all issues beginning with Number 7 Write to Forth Interest Group P O Box 1105 San Carlos CA 94070

The author is a lecturer in Physics at the South Bank Polytechnic London

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**Notice I am using the doctored rnd no generator*

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DISTRIBUTED PROCESSING

Industrial applications are neglected at our peril Here Professor Healey gives us an overview of microprocessor usage in this field

Applications

The use of digital computers in process control is not new Indeed much of the development of the minicomputer was based in this area For economic reasons, however, computer control applications were restricted to large scale, expensive projects such as steel works and petro-chemical plants

The advent of cheap LSI computing has dramatically reduced the cost of digital control, the most important aspect of which is the vastly increased range of applications which now become viable Equally it becomes attractive to implement complex control systems by a multiplicity of simpler interconnected sub-systems Since such a concept involves the use of a communications system the question can now be asked as to whether such systems can be profitably coupled to other computing systems such as an order processing system Thus in some ways the very simplicity of the basic microcomputer system is attracting a new degree of complexity in the *interconnections*

The process control computer concept has been implemented on two levels supervisory and direct closed-loop control Data logging and display is arguably a third level In a supervisory role the process under control utilises conventional analogue controls the set points of which are fed from a computer via a digital-to-analogue convertor For direct digital control the instantaneous output variables from the plant are measured by sensors sampled repetitively and fed to the computer via analogue-digital convertors The computer in real-time computes a corrective control action which is fed back to the process via DACs (Digital to Analogue Converters)

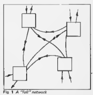
Fig 1 A "full" network

The design of suitable closed-loop control algorithms has exercised control theoreticians for many years, but the attraction of a digital controller over an analogue controller is its potential for implementing more sophisticated and non-linear controls Inclusion of the computer *inside* the loop is more complex than supervisory control

By utilising a digital computer in a control scheme the operator interface can be improved e g utilising colour graphic displays to substitute for banks of meters and alarm lights

In addition to the more sophisticated closed-loop control systems most machinery requires some form of sequential controller These are traditionally implemented by electromechanical relays or solid state logic but recently by microprocessor-based controllers With a micro the best of both worlds is possible improving the quality of a sequential controller by arithmetic refinements, improved operator input and display and improved reliability It now becomes a relatively simple process to add data capture facilities to the controller for local display, and more important, for integration in a network. It must be made clear that with the latest component costs such concepts are to be considered from the most complex chemical process down to simple machine-tools

While it makes sense to build data capture features into a new machine design involving microprocessors, there is a vast base of installed machines with no logging facilities In a few cases it may be practical to replace just the controller on a machine but more likely is to simply add a special purpose "shop-floor data capture device" Some will be directly wired to machines others will be badge readers or key switches manually activated by the operator

If the basic concepts of closed loop and sequential control are taken to the obvious limit then, by integrating materials handling, processing or machining and scheduling, the automatic factory will evolve The whole field of materials handling, Robotics, automatic warehousing, etc becomes viable with cheap controllers True Robotics, machines which will perform complex and variable functions as opposed to repetitive sequences, is an area of complex control in itself Thus any automated factory will be a complex of integrated control systems

Automated production equipment with facilities for remote control and data logging must eventually be coupled to higher-level supervisory machines By adding data-capture equipment on a factory floor then production levels down time recording, accumulated work hours etc , can be recorded and displayed Better, however is to collect the data into a central control room where an overall picture of current machine state and loading can be displayed

To fully exploit such a system, however the data should be related to the commercial data processing information Thus machine scheduling can be related to orders and stock requirements, dynamically re-scheduled in the case of a machine failure, information which is immediately relayed to shop floor management Machine efficiency measurement and planning of preventative maintenance are all possible One point that should be noted now is the potentially dangerous practical problems created by the wide range of disciplines involved from commercial DP to process control engineering It will not be easy to integrate people who are traditionally isolated and in many cases of diverse opinions It is further important to realise that the greater the reliance placed on computer *control* the more accurate must be the *data*—inadequate shop floor data capture has ruined many systems in the past

Technology

The essence of a process control computer system is multi-tasking. A controller is made up of a number of tasks, many 'active' at the same time, basically independent but with a controlled interconnection mechanism Since a computer is a sequential device, special "real-time operating systems" have been developed, particularly for minis to schedule and control the execution of tasks on a priority basis activated either by external events or synchronising requests from other tasks * The software system is pretending that the single computer is a multiple of small dedicated processors, closely coupled together, in other words, simulating parallel processing The route through to multiple physical processors is rather obvious as soon as low-cost hardware becomes available Add to this a practical consideration that a process plant may be very big so that the cost of cables connecting sensors and actuators back to a central computer can exceed the cost of computers Thus multiple localised control computers linked together by telecommunications lines can be cost effective This use of a computer to code and multiplex information for communication is common in Telemetering systems already

The above picture indicates a role for both tightly and loosely coupled systems, loosely coupled sub-systems each of which may involve tightly coupled processors The tightly coupled processors are a solution to the requirement for parallel processing, which must be superior to sequential sharing of a common processor

Of more interest here are the loosely coupled machines since there are various methods of connection

Is it desirable to create a hierarchical or a true network structure as shown in Figs 1 and 2? Clearly a network will allow maximum interaction between subsystems and, with route-through, a degree of tolerance to communication system failures

However, the biggest problem with a complex control system will be what happens when an element in the network fails? If the control schemes are designed so that the feedback at one controller depends upon variable data from another unit and that unit fails, then performance may be seriously impaired and possibly operation could become hazardous On the other hand if the control schemes are designed so that they function in the main with their local variables and will give tolerable results with no control then a hierarchical system can give further improvements In this case the supervisory computer can absorb information from each station and return information regarding set points for optimised performance Failure of any system component will result in reduced performance, but not disaster Further, it becomes easier to identify which processors are the more critical and therefore which to duplicate However, the concept of "graceful degradation", whereby a failed processing element is replaced by another rejecting a lower priority task is not possible, since the processors and their associated sensors/actuators are geographically distributed Graceful degradation can only be implemented by multiple processors at a given node

The hierarchical concept is also very appropriate to automated and integrated factories Here a shop-floor machine can collate data from the individual machine processors and display local results This data can be collected by a local DP computer, which also feeds down information regarding desired machine scheduling, stock movements, etc The local DP computer can in turn link to a head office machine so that production/delivery can be linked with order processing, stock ordering, invoicing, etc This is a natural hierarchy In summary a network offers total integration a hierarchy is much more tolerant

If the nodes are so far distributed that post office communication lines must be used then there are problems of speed and availability Public networks will obviously be of some use when established However in house, many environments are electrically noisy so that the most exciting prospect is the use of fibre optics for interconnections There can be very high-speed and ring-type structures similar to those proposed in office complexes will be most convenient

If an integrated production system is relating data to a Data Processing (DP) computer then there is a growth in the volume and variety of data becoming available Equally true the availability of all this data will attract various users As an example engineering drawings originate in the drawing office copies of which are used around the factory A modification updates the master copy but how many old versions are still in use? Thus if all drawings and updates of them are placed in a central computer filing system, the user can have a guaranteed up-to-date copy This same basic data can now be used as the basis for Bill-of-materials listing, stock ordering etc Thus the concepts of Data-base technology are of importance to industrial systems This is even more pronounced where experimental results are concerned e g pilot chemical plants

With engineers and financial controllers involved on the fringe of a distributed industrial control system, there will be growing use of independent "personal computers" The need for an integration of these machines with the data bases and for shared programs, etc may lead to some high-level network systems e g a plug-in system with a "ring-main" piped around the offices At the simplest level file transfer procedures for data transfer

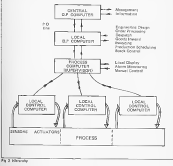

Fig 2 *Hierarchy*

***Editor's Note** *See the series on Operating Systems by Paul Martin Issues 4 to 7 of* CA

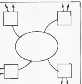

Fig 3(a) *A ring network*

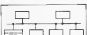

Fig 3(b) *A bus network*

between personal and central machines will still be needed

Software

We have already identified the need for communications software both point-to-point and networked

Complex multi-tasking software may be replaced by simpler control software plus communications software with a hoped-for improvement However even a simple data logger must have a minimum of multi-tasking support if the control routine and the communication software must be concurrent Suitable real-time-operating systems (RTOS) are well established for minis but micros are currently far well less catered for—INTEL's RMX-80 is a notable exception

Unfortunately, most network software has grown up around a specific manufacturer's products i e SNA (IBM) and DNA (DEC) The noted difficulty of interconnecting products from various vendors is bad enough in data processing but is most worrying in industrial control since no one company can hope to cover the range of machines involved An international task-to task protocol, at least one level higher than X25, would be most desirable

Developing application programs for industrial control systems also demands a variety of tools On the DP side transaction processing and data bese software are needed It is highly likely that distributed data beses or at least remote interactive software are also needed Since mainframe machines may often be involved Transaction Processing (TP) monitors are commonly used but smaller systems, e g the on-site supervisor computer can take advantage of the much cheaper interactive—COBOL or BASIC systems commonly available on minis At the bottom level of the hierarchy the data capture or local controller machines will seldom support terminals and discs for program development Programs are developed on a separate machine and either down-line loaded bu the communications linkes or are burnt in PROM and physically transferred Beware under-costing the development of simple microprocessor software because of the problems of debugging a full supporting Microprocessor Development System (MDS) with In Circuit Emulation (ICE) is needed The MDS will provide high-level language and run-time executive support

Having established tools to program machines and executives to run those programs and communications systems to interconnect them there still remains the problem—what does each machine do? In the case of a data capture machine, say the problem is fairly self contained and relatively easily specified In the case of a fully distributed control system the choice is not so easy, in fact the availability of distributed hardware has created a need for new Control theories Idealised optimal control assumes that *all* outputs are available to compute a new vector of *all* inputs, with distributed control *some* outputs are available to compute *some* inputs only Further control theories must be developed to assess how inputs and outputs can be decomposed into separate groups and yet retain safe operation if any group fails ■

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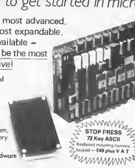

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APPOINTMENT WITH A COMPUTER

Professionals want to exercise their professions rather than enter a paper chase

In this article the application of microcomputers only to General Dental Pratice will be considered as this comprises the vast majority of the dental profession in the UK

At the present time — April 1980 — there are probably less than twenty dental practices which use computer systems in the UK, although several companies heve been interested in this market

Eighty per cent of dental practitioners work in group practices and although the number of dentists will vary from two to ten per group practice 40 per cent are three- to four-man practices The typical structure is a one- or two-pertner practice employing a number of dentists This is in complete contrast to the EEC where most dentists work alone

Dentistry can be divided into three main areas with regard to computer assistance

1 Practice management
2 Patient appointments
3 Patient treatment records

Practice Management Can be defined to include such subjects as

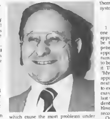
1 Practice accounting and analysis
2 Patient receipts and debt control
3 Patient six-monthly check-up reminder letters
4 Stock control
5 Practice management information

Patient Appointments Divided into

1 Making appointments for petients and producing appointment cards
2 Issuing six-monthly check-up appointment letters
3 Producing daily lists of petients booked for each dentist with categories of work and time allotted
4 Issuing letters to patients who fail to keep appointments

Patient Treatment Records Covers such functions as

1 Patients registration e.g Name Addresses etc
2 Patient medical problems e g Diabetes
3 A record of the treatment performed at each visit plus relevant payments
4 A special graphical representation of work performed on a multiple square grid called the dental chart



If one now examines these three application areas one can uncover the points which cause the most problems under existing manual methods

Practice Management

1 Recall letters are issued every month to remind patients to attend for six month appointments Each dentist may issue up to 200 letters, so a four-man group practice could post 800 per month This is an extremely laborious and time-consuming job well suited to a microprocessor

> **"Eighty per cent of dental practitioners work in group practices"**

2 As the NHS patient charges increase and more practices turn to private treatment more cash is handled by the reception staff An accurate and 'fool proof' cash control system is important to stop pilfering and once again is well suited to microcomputers It also directly relates to debt control

3 Practice accounting is important to all practices and little will be discussed here since dental accounting is similar to that in all small professional practices

4 Stock control and additional management information which a computer can provide, are extra bonuses but in themselves would not justify purchasing a system

Patient Appointments

1 In a practice with four dentists and one dental hygienist there will be five appointment books There will probably be two receptionists and a queue of patients waiting to pay money and make appointments It can be very time consuming to wait for an appointment book to be free if the other receptionist is using it The worst possible situation is

'My name is John Smith and I have an appointment with one of your dentists next week It can easily take 20 minutes to examine all the books only to find with exasperation that his appointment was last week and he has come to the wrong dental practice! A computer search would have produced the answer in only a few seconds

Once again all the other functions listed under appointments are useful, but the main benefits of computer appointments are the ease of making them and the speed of retrieval

Patient Treatment Records

Each dentist over a two-year period will probably see 2 000 *different* patients In a five-year period this could be 3-5 000 and varies greatly from practice to practice Using our hypothetical four man practice there is a need to store 20,000 record cards and to be able to retrieve them quickly and easily This is a major problem in most dental practices The clinical information on these cards is vital to be able to provide the best possible treatment and very important for litigation purposes

The benefits are obvious in never losing records and being able to retrieve them in two-three seconds However, the dental "chart" imposes special requirements on the VDU to be able to display the appropriate graphics

This naturally leads on to a consideration of computer hardware

Hardware

As a result of trials at a pilot site it became obvious for the need of the equipment to be expandable A practice which becomes busier and finds it needs two receptionists instead of one would be very frustrated to have purchased a system not capable of multi-user facilities (more than one VDU being operated simultaneously) Also multi tasking is vital (the ability for the system to run different programs simultaneously on the various VDU's)

The number of truly multi-tasking multi user microprocessors available is fairly limited and we chose the 16 bit Alpha Micro as a suitable system The advantage of such a system can be seen by the flexibility of the hardware configurations required for the three different dental application areas described below

With a small two to three man practice, one VDU, one printer, one processor and a dual density floppy disc based system can be used However floppy discs are much slower than hard disc systems and once the practice increases above a certain size (three dentists), daily disc changing would be required which would make the operation clumsy If the practice decided to adopt an appointment system as well as a management system then a 10 Mbyte disc could be added which would render the floppy discs redundant but the original VDU processor printer and software would be used Thus expansion capability cannot be overstressed because once a computer system has been found to be of value, owners nearly always wish to expand into other areas they had not originally thought of and if the system is not able to expand the original capital expenditure is wasted

Dentists

Finally if a four man practice (or larger) were to decide to use management/appointments and treatment records system, a 90 Mbyte disc unit, processor, printer and at least six VDU's would be required, which is a lot of hardware

Cost Benefits

The advantages were outlined above in terms of increased practice efficiency, but in hard cash terms it is difficult to quantify There will probably not be any staff reductions, but the throughput of work will increase together with a reduction in appointment errors which waste time and money It will not be long before the computer forms which dentists submit to the NHS for payment can be filled out by the system which will save a tremendous amount of time

The fairest comment to make is that the quality of daily work life will be greatly improved, for both dentists and staff but at a cost This is where the computer manufacturers and distributors should take note in that most businesses could benefit from a computer system, but whether they can afford it is a different matter The computer industry should aim for high volume, low unit profit production, otherwise many markets where computers could be applied will not be reached if the basic hardware costs are too high

A word of caution

To the prospective buyer, the author would suggest the following points

1 Ask to see a satisfied customer who is not involved with the relevant company

2 Make sure the company has a reputable background of computer professionals and not amateurs

3 All the running and maintenance costs are investigated thoroughly for each system

4 Make sure the system is capable of being expanded

5 Check to see that the relevant NHS and professional safeguards are present, e g ability to print separate NHS and Private receipts

6 Do NOT go to a software company who have no specialist knowledge of dentistry as it is unlikely that they could afford to spend the time (and money) in acquiring a detailed appreciation of your needs and develop a special one-off software package

7 Decide what it is you want and make sure that this is what you buy ■

The author is a practising Dental Surgeon and Joint Managing Director of Benn Data Systems Ltd a subsidiary company of Health Computing Ltd. He has had a practical interest in the application of computers to dentistry for the last seven years.

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BRAND NEWs 8

compiled by Microspy
with Anthony Esgate

This middle section may either be pulled out or photocopied then filed for reference It will be comprehensive and range over the whole field of products services events and courses **PU** stands for Personal User **SB** stands for small base – that is small budget or small business **MB** – medium base medium budget or medium business **BB** – big base big budget or big business **Addresses** are to be found at the end of **Brand News.**

Systems

ADDS SYSTEM 75A

ADDS (UK) LTD

SYSTEM 75A modified version of System 75 52K RAM microprocessor based system 2 or 3 single sided single-density discettes with 0 25 Mbyte storage per drive 1920 character VDU alphanumeric keyboard with communications and printer interface circuits power supplies and console ADDS operating system software FORTRAN IV and extended BASIC interpreter ISAM index for file structure utilities ADDS VANTAGE applications software also available for sales ledger purchase ledger nominal ledger stock control and payroll – can run as independent applications or as part of integrated system Order entry and sales invoicing can be run using the sales ledger and stock control modules £4 000 for system £500 for each VANTAGE module **SB, MB**

BURR-BROWN INTERNATIONAL LTD

CS450 Programmable Data Acquisition and Control System Comprises general purpose microcomputer system (keyboard display CPU 32K RAM memory mass storage facilities) with addition of a number of special interfaces a real time clock/calendar and special software Range of applications involving data capture and processing in real-time System can issue control signals provide status information or commands to an operator or record processed results on a floppy disc An autostart facility loads the program at power on allowing operation by unskilled personnel **MB BB (Scientific/Industrial)**

CONTROL DATA

CDC Model 740 latest addition to Cyber 170 Series 700 range of large scale computers which now contains five models – 720 730 740 750 and 760 740 is field upgradable to 750 and 760 and compatible with software and peripherals used with previous Control Data systems Model 740 CPU consists of nine arithmetic functional units each specialised for particular instruction types to increase efficiency over a unified CPU Also Model 740 includes an instruction stack that eliminates memory references on previously executed instructions Model 740 central memory is built with 4K static metal oxide silicon (MOS) chips and available in sizes from 1 31 million to 2 62 million characters Central memory is organised into 8 logically independent banks of 60 bit words which permits 10 6-bit characters to be stored in each word Extended memory consisting of logically independent multiphased banks is available in sizes from 5 million to 20 million characters Prices from £831 000 with 1 31 million characters main memory including 10 peripheral processing units and 12 input/output channels to £1 022 000 with 20 peripheral processors and 24 I/O channels Monthly leasing under one year contract from £20 700 **BB**

EXTEL

SYSTEM 20 Microsystem Meets needs of small business and those of the big company implementing a distributed processing network Z80 based with CP/M operating system and extended BASIC has 64K of main memory twin (571 Kbytes) floppy discs and options for 2 more floppys or a fixed (13 7 or 27 4 MByte) hard disc as well as Newbury VDU and printer Two immediately available software packages Cladius commercial application packages from Cooper and Lybrand Associates Ltd for business operations from invoicing and processing of orders to stock control and production of management reports and Property Management from RAM Software Systems Ltd which handles full range of property management functions (Diary system/letter production automatic rent demand/reminder production accounting etc) £4 650 for basic system **SB MB**

GENERAL AUTOMATION

Four new members of GA 16 solution series *GA 230 240 470 480 All compatible with existing hard and software for GA 16 solution series but providing enhancements in packaging performance and price/performance ratio GA 230/240 are improvements of the GA 220 computer using GA Hypak memory technology GA 230 has 128 KByte of 22 bit ECC memory on one board with a potential of 512 KByte per board GA 240 has an extended instruction set providing for up to 100% increase in peformance dependent on the application software Field upgrade from GA 230 to GA 240 available GA 470/480 are enhancements of GA-480 taking full advantage of technological advances in processor design and memory packaging GA 470 has 128 KByte 22 bit ECC memory GA 480 has 256 KByte ECC memory expandable to 2 MByte in a single chassis in increments of 256 Kb (1 Mb can fit on a single board) Field upgrade from GA 470 to GA 480 possible All GA solution series computers are supported by the CONTROL Rev 4 operating system providing full upward and downward compatibility of applications* **BB**

▶

EXTEL System 20 SC2 Computer System

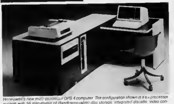
BRAND NEWs

HARRIS

9200 range of microprocessor based information systems First two models are *9210* supporting up to 32 devices per system with IBM 3270 compatibility *9220* offering additional ability to communicate concurrently with multiple hosts in BSC and/or SNA/SDLC protocols Architecture provides advanced networking capabilities and allows for modular additions as required by network growth. Peripherals include 80 130 and 180 c p s bi-directional dot matrix and 240 or 300 l p m band printers non-glare low profile 15 inch displays with green phosphor characters on a black background at 3 intensity levels 960 1920 or 3440 character screen sizes available also status line feature to highlight operating and status messages (options include 75 and 87 key detached data-entry typewriter key punch style keyboards photopen light sensor and a magnetic slot reader) Self-diagnostic capability enables processor to perform automatic testing of system components also line trace facility permits communications line traffic to be displayed as events occur **MB, BB**

HONEYWELL

DPS 4 multi-processor computer system designed specifically for new small user Designed and built in Italy the smallest DPS 4 system is equal in power to the largest Level 62 machine the Model 35 Maximum DPS 4 power is 5.3 times it's minimum A DPS 4 system can be expanded on site to a total of 12 processors Honeywell Business System (HBS) software is available offering a total of seven applications – Sales Order Processing Inventory Accounting Sales Ledger Sales Analysis Purchase Ledger Purchase Order Control and General Ledger – all of which can be run under office staff supervision In addition Level 62 software can be used without modification Operating system is GCOS 4 based on Level 62 GCOS offering both multi programming (15 job streams) and multi processing capability The Interactive Processing System (IPS) integral in GCOS 4 gives computing options "menu style" on screen Options enable users to interactively create display and print files directly define and produce reports enter data modify records and make file enquiries carry out program development and compilation launch programs inspect jobs whilst running and access job print-out reports from on screen examination An entry level DPS 4 system comprising 4 processors 256 KBytes of memory 56 megabytes of fixed/removable disc storage video console 2 work stations and matrix printer costs about £30 000 In addition new *DPS 8/20 DPS 8/44 DPS 8/52* complement previously announced DPS 8/70 in large computer range Compatible with Level 66 systems all DPS 8 systems support GCOS 8 operating system which was designed for the distributed systems market Quadruple processor DPS 8/70 has seventeen times the power of DPS 8/20 which costs about £300 000 for a typical system (CPU one System Control Unit (SCU) 1 MByte main memory one 19-slot Input/Output Multiplexer (IOM) DPS 8/20 memory can be expanded to 2 or 4 MBytes and the system is field upgradable to DPS 8/44 DPS 8/52 comprises free standing central system of one CPU one SCU 1 MByte main memory and one 36-slot IOM expandable to 52 slots Memory expansion can be up to 8 MBytes and the system is field upgradable to DPS 8/70 Honeywells most powerful computer New peripheral processors have been announced for DPS 8/20 and DPS 8/44 including a multi-function processor MFP 8000 which can support 8 tape handlers and 4 unit record devices and mass storage processors MSP 8000 (single channel) and MSP 8001 (dual channel) **MB, BB**



Honeywell's new multi-processor DPS 4 computer The configuration shown is a six processor system with 56 megabytes of (fixed/removable) disc storage integrated discette video console and matrix printer

MIDWICH COMPUTER COMPANY LTD

Franchised distributors for SGS ATES Ltd new Z80 Development System Based on CL Z80 microcomputer features Z80 2.5mHz CPU 16K RAM 10K ROM Based Operating System Assembler/Editor EPROM Programmer compatible with M 2704 2708 2758 2716 2732 UV Erasable EPROMS video interface and display (64 x 16) Alpha numeric Keyboard (ASR33 type) Dual Cassette Drives 1 Serial (RS232/20mA/TTL) and 4 parallel (2280 P10) interfaces £1 495 inc comprehensive manuals but excluding VAT **PU, OEM**

NEWBURY LABS

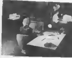
NewBrain handheld microcomputer Full typewriter keyboard (96 upper/lower case ASCII/150 characters 32 ASCII/150 control codes) Self contained one-lined display Compiled ANSI standard BASIC high speed arithmetic with advanced functions accurate to 10 significant figures versatile editors for text processing Numerous interfaces composite video (to drive monitor) bi-directional V24 (printers teletypes modems VUDs) user port analogue dual cassette and bus connector (for memory & other expansion)

A TV set can be interfaced via UHF module Additional interfaces or memory fit into universal extension boxes Software extension modules plug into extension boxes also (up to 4 MBytes) and modules in development include assembler COBOL and Pascal as well as utility packages in BASIC and code Standard BASIC is enhanced with user controlled formatting of numeric output, advanced I/O for cassette tape file handling and interfacing to other equipment and string and logic functions Viewdata key to be used in conjunction with NewBrain Viewdata module also graphics key which produces 64 viewdata graphics symbols or other graphics symbols Three models *NewBrain M M6* and *M8S* from £195 to £245 M8 is mains powered but has rechargeable batteries enabling machine to run when temporarily disconnected M8S employs low dissipation components for prolonged battery use M is mains only and has no built in display so must be used with TV or monitor Display switches off after one minute for power conservation **PU, SB**

Newbury NewBrain

PRIME COMPUTER

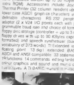
OFFICE AUTOMATION SYSTEM Word processing electronic mail document management text management and data processing capabilities System based on Prime 50 series computers with three new peripherals – PT45 management workstation for high speed management communications data processing input and retrieval word processing and electronic mail PT65 intelligent administrative workstation enhances PT45 with instantaneous word processing responses horizontal scrolling tab and indent retention vertical tab and changing of margins and a new letter quality printer Word processing key driven menu orientated facilities for creating storing retrieving updating modifying and deleting a document library maintenance and batch correspondence Text Management provides proof reading spelling checks hyphenation and multi lingual translation utilising user maintained dictionary with initial 60 000 word vocabulary Management communication and support software provides electronic mail with capability to annotate send forward re direct acknowledge dispatch and receive document management with full filing retrieving and archiving and management tracking and scheduling functions including calendars message logging and reminders Typical system 20 PT65s 5 PT45s 6 printers 1 Megabyte Prime 550 with 2 x 80 Megabyte discs and one 1600 bpi tape drive [illegible] **SB**



Prime Computer s Office Automation System

TEXAS INSTRUMENTS

TI 99/4 Talking Computer Consists of console with 16K RAM sound generator full colour graphics extended BASIC and optional speech synthesizer Utilizes plug in command modules for personal finance record keeping education or entertainment applications (modules contain up to 30 Kbytes of extra ROM) Accessories include Joystick Thermal Printer (32 column resident upper/lower case ASCII graphics characters user definable characters) RS 232 peripheral adaptor (2 x V24 I/O points each with programmable baud rate and choice of format) floppy disc storage (controller + up to 3 mini floppy drives with up to 90 KBytes capacity formatted) and speech synthesizer (built in vocabulary of 373 words) TI Extended is full floating point 13 digit extended BASIC ASCII and ANSI compatible 33 statements 19 functions 14 commands editing facilities colour graphics and sound and music over five octaves A TI BASIC manual is included



Complete with 14 inch colour TV monitor system costs from £990 including VAT Modules cost from £16 95 to £44 95 and those immediately available include Pre school Early Learning Fun Beginning Grammar Number Magic Household Money Management Personal Record Keeping Statistics Diagnostic Video Games and Video Chess **PU**

BRAND NEWs

VENTEK

4131 business orientated enhanced version of 4120 Datapoint 5000 processor 9374 disc unit with 20 MByte capacity 9462 multiport adaptor With Dateshare business time sharing package supports up to 16 8200 VDUs Using Multilink software package can communicate with other computers whilst eg data entry report generation or interactive enquiries take place Especially suitable for remote batch operation remote job entry intelligent data entry and transaction processing **MB**

Applications

ANGLIAN DP SERVICES (ADPS)

Order Processing and Sales Ledger package for MDS Series 21 microcomputer (originally designed for distributed processing) with min 64K Operator guided by screen prompts and error messages System security provided by multi level password security built in automatic data accuracy checks extensive housekeeping routines and comprehensive audit trail Order processing package built on 3 main files – Product (contains details of quantity standard cost/unit price VAT volume discounts) Customer (credit discounts orders area and rep codes) and Stock (handles up to 99 stock locations per product with up to 4 bins per product) ADPS claim system automates the complete order processing function from the production of picking lists through to the confirmation of orders production of delivery notes invoices and making up of back orders **SH MB**

BROWN'S OPERATING SYSTEM SERVICES LTD

IBM replacement TP monitor THIRST new release with support for IBM 3278 Model 5 132 character screen format Also allows users to break 1 000 terminal barrier **BB**

BUNZL

FASSET1 fixed asset accounting system Contains comprehensive asset register provides historically based depreciation charges (Current Cost Accounting) deals with regional development grants and includes a report writing system Has a multi group/division/company structure parameters user controlled Main assets can have sets of separately identifiable sub assets that can be acquired disposed and aged separately Supplementary information can be recorded in asset register such as utilisation maintenance costs and insurance values An exception log is used to record in chronological order adjustments exceptions and movements forming an Audit trail Reporting system has five fixed reports several standard reports and facilities for users to define their own reports For DEC PDP 11 FASSET meets the stringent requirements of the Accounting Standards Committee s SSAP 16 document [illegible] inflation adjusted accountancy standard **MB BB**

COMPSOFT LTD

DMS (Data Management System) for 32K PET Offers numeric functions search and sort routines print options and label processing Up to 5000 items stored on single floppy accessible via key of up to 16 characters User can search on up to 4 criteria within across or on part of a field Functions (equal not equal less and greater than) allow sliding string searches and numeric range searches Report layouts user specifiable and reports may be sorted on any field or total requested at end of a print Files may be copied with data dropped or space inserted Arithmetic may be performed on whole file or selected items allowing for gross profit calculation currency rate updates etc Over 60 sold **SB**

COMPUTERCRAFT

LIFE 1 Game for APPLE II or ITT 2020 Written in machine code LIFE 1 comes complete with comprehensive user guide £9 inc VAT and post and packing **PU**

COMPUTER TECHNOLOGY LTD

CAPITOL software package based on PACS the production and inventory control package marketed by PA International and Pactel incorporates modules for forecasting inventory management materials requirements capacity planning shop floor control and costing. Runs on all ICL equipment including 8000 series **MB BB**

CMC

TEXTPRO word processing package for REALITY ROYALE minicomputer/business information system Runs in terminal (modified if necessary to 48K with slightly altered keyboard layout) using CPU only to retrieve and file on database Electronic mail facilities using standard communication features and protocols TEXTPRO has 3 modes of operation COMMAND for reading a document from disc into terminal memory and back again EDIT for creating or altering a document as required and RUNOFF for producing hard copy **MB BB**

DATA GENERAL

TPMS (Transaction Processing Management System) for ECLIPSE running under AOS Monitors multiple terminal operation provides interactive screen format generation user definition of logical transactions flexible system and data security file back up and recovery and exceptional transaction throughput TPMS integrates AOS resources required to develop and run transaction oriented applications including COBOL and PL/1 INFOS II file management system interfacing program restart and recovery procedures and support of large terminal configurations Also provides control features such as dynamic system tuning and master console controls TPMS has two major components – TCP (Transaction Control Program) which is used for development of transaction applications scheduling and distributing terminal requests for application transactions and overall control of TPMS system environment and CCP (Console Control Program) which activates terminal screen formats validates data entry and maintains a log of transaction activities There is a LIBRARY utility which maintains an active catalogue of system application programs and formats Software fee for initial DG/TPMS license including installation for one year Software Subscription Service (SSS) one year Comprehensive Support Service (CSS) and one training credit is £3 586 DG/TPMS subsequent software fee is £1 956 Quantity and OEM discounts are available **OEM BB**

ESDU (Engineering Sciences Data Unit)

COMpac 7004 Interactive computer graphics package for estimation of fatigue life of a cum

BRAND NEWs

The E DIT package for fatigue damage estimation under variable amplitude loading being run on a Tektronix 4051 graphics computer

ponent with stress concentrations subjected to a variable amplitude loading taking account of the inelastic stress history at root of the notch Package requires no special training in computers or languages Results are viewed on a Tektronix 4051 **Engineers**

GREAT NORTHERN COMPUTER SERVICES LTD

MAGSAM keyed file management system for the management of Indexed Sequential Files Implemented through simple BASIC statements allows multiple indexes file space dynamically allocated and re used tests show that MAGSAM can cut program development time by up to 50% Package includes file dump utility tutorial program and 108-page user manual Originally developed by Micro Applications Group of Van Nuys California MAGSAM III for CBASIC Microsoft BASIC or Micropolis BASIC costs £110 to end users High-speed assembler version for CBASIC will be available shortly at £210 **SB**

HARRIS SYSTEMS LTD

In conjunction with Hull University have developed a new Pascal compiler specifically for University/Polytechnic students of Computer Science Supported under Vulcan operating system compiler will be available in the late summer for Harris 100 500 and 800 series of computers Compiler implements full British/ANSI standard Pascal and allows user to specify non Pascal procedures (eg in existing libraries such as NAG and GINO Vulcan Indexed Sequential Package (VISP) and Sort Merge routines) Main features of language include sets with at least 96 elements strings of indefinite length with both upper and lower case characters advanced diagnostics more efficient run time code in line machine code facility and two types of external procedure Optional run time checks include arithmetic overflow subrange validity array index bounds pointer validity and variables properly initialised Debugging aids include symbolic post mortem dump on run time fail statement trace facility run-time profile analysis source program index and cross reference Harris plan to add the Hull Pascal to their range of Commercial language processors which include FORTRAN 77 APL BASIC COBOL RPGII and SNOBOL

LIFEBOAT ASSOCIATES

VSORT The thinking man s sort High speed sort merge system which can be used as a stand alone utility or an assembly language subroutine to CBASIC When used as latter rolls out entire run time package and calling program to disc to maximise buffer space available for sorting (increases speed of sort for large files) VSORT will sort fixed length records of up to 255 bytes long using up to 5 fixed or variable length fields Requires CP/M compatible operating system and 32K RAM when used in CBASIC subroutine mode Also available for use with modified versions of CP/M for TRS-80 Model 1 HEATH H-8 and ZENITH Z 89 Supplied with documentation demonstration programs and data files £105 inc manual (manual alone £15) **PU**

PETSOFT

(Part of ACT Group) *Talking Calculator* Program generates speech via soundbox (illustrated) connected to user port of Commodore PET Program causes the name of each numeric or function key to be generated as synthetic speech followed by result of calculation (also monitored on screen) £10 + VAT from PET dealers or ACT in Birmingham Soundbox extra **PU**

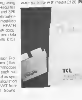
Petsoft Soundbox for 'Talking Computer

STAGE ONE COMPUTERS

Software products for PET (i) *PETAID Version 4 Indexed Access Method* Able to file or retrieve records by alphanumeric coding Incorporates Date and Value Fields with right hand justification for value fields repetitive search features screen field prompt on fields being amended or inserted All facilities are menu driven and alphanumerical fields can be searched on a greater or less than criteria within a given position in that field (ii) *PETAID Extract and Sort Routine* Enables users of random access PETAID to take an existing file created by PETAID and specify a field within the record either alpha or numeric on which an index is required to be created (max no of records 850 per discette) After index has been extracted on first 15 characters of the designated field and the records relative record number index is sorted into strict alpha and numeric order and filed on disc as an index file Multiple secondary indexes may be created in this way Package contains also an index search and display and an index search and print in which the user can search or search and print for particular or all contents of the index (iii) *Double Precision Mathematics Package* in machine code which resides at the top of memory and provides integer accuracy for values up to 54 900 000 000 Utility takes 700 bytes of memory and can be loaded from a BASIC program (iv) *General Accounting Package* designed for a 32K PET with floppy and printer will cater for up to about 4000 accounts (v) *Incomplete Records Package* All due for release shortly **SB**

TRANSAM

Pascal Compiler Available on standard IBM 3740 format 5¼ or 8 discs to run under CP/M Extensively documented easy to use with full error messages TCL Pascal Manual available separately at £6 documented software the kit with media £120 **PU SB**



UCC

ELEVEN replacing FIFTEEN is an automated job re run and tracking system FIFTEEN currently automates manual tasks normally associated with re run set ups and execution ELEVEN monitors the re run situation and supplies information for setting operational policies as well as handling the set up and execution of re runs and re starts ELEVEN is supported by OS Console TSO CICS ROSCOE and JES3 In addition there is an online batch driver which simulates a Console I/O via the SYSIN and SYSOUT data sets **BB** (IBM)

WESTINGHOUSE MANAGEMENT SYSTEMS

ABR (*Automatic Backup and Recovery*) option to Fast Dump Restore (FDR) for users of IBM OS operating system (ie MVS SVS VS1 MVT and MFT on IBM or equivalent mainframes) Allows FDR users to automate backup based on last reference date of a data set and various data set characteristics Also archives and scratches datasets which have not been used for specified period of time releasing disc space £4 000 **BB** (IBM)

WOOTON JEFFREYS AND PARTNERS

INTEROPT large-scale linear programming system for both batch and interactive use System is interactive feature overcomes need for specialist programming knowledge and the probability of delays inherent in most batch systems INTEROPT can handle large problems with over 1000 constraints in time sharing mode and performs efficiently in core runs for smaller problems Comprehensive HELP messages are provided for inexperienced users System and most problem parameters have default values and errors are rapidly detected in interactive mode system allows user to detect data errors with computer and watch solution converge to an optimum (user can interrupt optimisation for detailed summary to change tolerances algorithmic control parameters or to utilise other options Alternatively INTEROPT can run in batch mode with full handling data input solution output interactively or entirely in batch mode INTEROPT is available as a package or bureau service **BB**

Discs, Tapes, Punches, Readers

CONTROL DATA

CDC 9455 8 rigid disc drive combines fixed and removable disc storage for use with mini and microcomputer systems from other manufacturers Provides 8 million bytes of data storage on a fixed disc and another 8 million bytes on a removable disc cartridge Microprocessor based control logic 19-inch rack mountable design Removable media is CDC 9 1208 disc cartridge (data transfer rate to or from the cartridge – 9 67 million bits per second) providing interface and format compatibility with CDC range of industry standard module drives CDC 9 1208 has no dual covers is self sealing and includes a write protection tab Requires no head alignment pack due to a new head positioning technique **MB**

PEREX

PERISTORE HD 6400 tape drive 6400 b p i cartridge drive utilising 3M data cartridge to provide an unformatted storage capacity of over 17 million bytes of information PERISTORE also handles program loading data editing and sorting as well as functioning as data interchange medium Die cast chassis incorporates gimbal mounted motor permitting drive to be located in any position with correct capstan pressure About £900 **OEM, MB**

Perex PERISTORE HD 6400

Kennedy

Model 640 cartridge recorder A magnetic tape storage device designed particularly for Winchester back up storage Uses standard DC300A ¼ inch data cartridge with 4 tracks and unformatted capacity of 17 3 MByte with a 450 foot cartridge and 11 5 MByte with a 300 foot cartridge Records at 6400 b p i using GCR recording format Utilizes serpentine recording (each of 4 adjacent tracks recorded in opposite directions) to eliminate rewind time Inadvertent data erasure protection 30 i p s reverse search forward search and rewind operations performed at 90 i p s Features infrared emitter phototransistor detector system replacing standard filament lamp photo sensor which is tolerant of ambient light and thus eliminates a cause of erroneous hole detection In addition *Model 650* formatter integral to Model 640 disc back up cartridge to reduce host computer overheads and increase data integrity Incorporates data recovery system employing Group Coding Techniques and Cycling Redundancy Checking procedures Simplified host computer hardware and software interfacing – a single DMA controller can be used for both disc drive and cartridge transport **OEM MB**

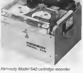
BRAND NEWs

Printers

CENTRONICS

Model 6080 Quietised Band Line Printer Based on 6000 series 6080 has noise output of less than 60 d b a Due partly to mechanical improvements acoustically designed cabinet Internal feeding and stacking of paper Meets German VDE and other European safety standards Other features include operator changeable print bands (for different character sets etc) microprocessor electronics 132 characters/line 15 i p s paper slew rate 10 c p i horizontal control 6/8 l p i vertical spacing selection of standard interfaces Also available *Model 737* miniprinter for microcomputer systems with print quality suitable for text processing applications Fan fold roll or cut sheet paper handling True underlining and subscript/superscript capabilities Proportional/monospaced spacing modes with 80 c p s 50 c p s respectively 10 c p i and 16 7 c p i modes N x 8 (proportional) or 7 x 8 (monospaced) dot matrix 96 character ASCII expanded print right margin justification 21 l p m with 80 columns 58 l p m with 20 columns printed 9-wire print head one line buffer Optional acoustic cover Prices in OEM quantities – 6080 – £2 400 737 – £430 **OEMs, SB, BB**

Centronics 6080 Quiet Line Printer



Kennedy Model 640 cartridge recorder

DATAPLUS LTD

Distributors for EPSON (UK) Ltd s new *TX-80* 80 column alphanumeric dot matrix printer Produces upper and lower case characters and graphics on paper up to 9½ wide Friction feed for plain paper or tractor feed for sprocketed stationery (single multi-part or label stock) 7 needle ballistic head printing uni directionally at 150 and 70 l p m Head life estimated at 100 million characters and mechanism at 5 million lines Parallel (Centronics compatible) interface standard Optional cards and connecting cables for PET APPLE TRS 80 micros IEEE488 RS 232 and 20mA current loop can be provided Baud rate selectable from 300 to 9600 £445 plus VAT **PU, SB, OEMs**

FACIT

Two new matrix printers *4520* and *4521* Bi directional print mechanism with 60 lines of 80 columns per minute throughput 9 x 7 matrix character font Z80 microprocessor makes printers intelligent and fast enough for connection to data logging and microcomputer systems Covers all language versions current in Europe as well as US ASCII Serial RS232 and parallel interfaces standard *4520* has journal roll and friction feed *4521* features fan fold and pin feed Quiet to run and designed in accordance with European safety and interference standards **MB, OEM**

The Facit 4520 matrix printer

GENERAL ELECTRIC COMPANY of the USA

TermiNet (R) 2000 impact printer family incorporates unique printhead for low sound levels and long life First two in series are 30 c p s *TermiNet 2030* and 120 c p s *TermiNet 2120* both microprocessor based Bidirectional 7w x 9h dot matrix printhead mechanism Print density selectable at 10 13 2 and 16 5 characters per inch along 13 2 inch print line Underlining Friction feed platen paper handling optional tractors 2 3 4 6 8 or 12 lines per vertical inch with five inches per second slew rate Microprocessor scanned keyboard with capacitative key switches layed out in accordance with standard ANSI ANSI/APL ECMA or modified ECMA/AZERTY/YZ A numeric cluster is optional Units use dual 8085 microprocessors offer a received data buffer and feature non volatile configuration memory Incorporate modular software and provide a full RS232C data interface (CCITT V24) Printers meet VDE RFI standards and employ switching type regulators GEC of the USA expects TermiNet 2000 to be used across a broad spectrum of data communications applications **BB, OEM**

TermiNet 2000 series

▶

BRAND NEWs

VDUs, Graphics, Terminals & Systems

ITT BUSINESS SYSTEMS

3289 four colour VDU designed to aid data recognition *3287 Model 8* 132 character width VDU and an *IBM 3278* plug-equivalent terminal were all launched at the Hanover Fair Deliveries are expected in 1981 **MB BB**

PRIME

Range of 4 interactive terminals (i) *PRIME NEWBURY 7002* based on Newbury terminal Teletype compatible 96 ISO/ASCII VDU Displays 24 lines of 80 characters per line and 7 x 5 dot matrix Baud rates 50 to 19200 in selectable half or full duplex mode £700 (ii) *PRIME NEWBURY 7009* based on Intel 8080A microprocessor software compatible with Prime s transaction processing software systems FORMS and POWER (FORMS (Forms Management System) is based on FDL a high level language for forms description POWER is a high level language for online query and reporting from central data base) 7009 has 2 page memory with block transmission from screen by line or page full keyboard editing features and full X and Y cursor controls £975 (iii) *PRIME LYNWOOD* offers IBM 3270 emulation through Prime s DPTX emulation software and is compatible with FORMS and POWER Enhanced page mode enables only modified fields to be transmitted and a macro facility means that commands from CPU can be stored as macro in terminal and invoked from line or keyboard 24 or 30 lines of 80 characters 128 character repertoire 5 x 9 dot matrix full graphics capability Reverse video underline and blinking Switchable transmission speeds 75 to 19 200 baud £1 685 (iv) *PRIME HYCOM 8* high-speed bi directional printing terminal Compatible with Prime s communications controllers 180c p s long life ballistic printing head field tested 1 000 million character life True lower case printing with descenders programmable horizontal and vertical tabs Prints in 9 high by 7 wide matrix with line length 136 columns Handles paper widths 3" to 15 5/16" and up to 6 multipart sheets with 12 round carbons interleaved £1 900 without keyboard £2 200 with **MB, BB**

TEKTRONIX

468 Digital Storage Oscilloscope Provides high digital storage bandwidth detection of aliased signals an envelope mode and correction of jitter problems Can also be used in real time non storage mode when performance matches Tektronix 465B 100MHz portable oscilloscope Uses a 25MHz 8 bit digitiser and novel display interpolation technique to achieve a useful storage bandwidth of 10MHz In storage mode which is push button selectable instrument is used conventionally and waveforms are acquired and stored as easily as in the non storage mode No storage level/intensity control interactions stored waveform does not bloom or fade Signal averaging facilities and cursors for time and voltage differences are provided Storage bandwidth of 10MHz highlights max frequency sinewave that can be usefully stored in a single sweep (useful storage bandwidth is based on digitising rate and display type – display technique used in 468 required 2 5 samples per cycle to display sinusoidal signals accurately at 10MHz bandwidth) Envelope mode uses dual sampling rates and records max. and min values of a waveform envelope into memory over a number of sweeps selectable from 2 to 256 Can capture narrow pulses on long sweeps to capture logic glitches view waveform excursions or detect aliasing Aliasing (the sampling of signals at too low a rate) is indicated by a solid band across CRT Jitter correction circuit corrects for half sample interval shift of waveform resulting from asynchronous relationship between trigger point and sample clock Optional signal averaging can be introduced to eliminate noise that is not synchronous with the trigger Up to 256 sweeps can be averaged to obtain 16 1 improvement in signal/noise ratio allowing signals as low as 500 micro volts to be viewed GPIB (General Purpose Interface Bus) option provides facilities for signal processing data logging and manipulation Instrument s 1024 word memory can store up to 2 512 word or 4 256-word waveforms Internal service routines check performance and optional read-only memory is available for additional service routines **Engineers, Labs**

The Tektronix 468 digital storage oscilloscope

Processor & Memory Boards, Chips, Programmers, Test Instruments, Modules, Training Aids.

CONTINENTAL SPECIALITIES CORP

LM 3 triggerable logic monitor Combines 40 variable precision threshold logic state indicators with flexible triggerable latching circuit in a single benchtop package Variable threshold facilities allow LM 3 to monitor up to 40 logic points simultaneously on any type of circuitry while different triggering modes mean that it can be used to follow logic states or freeze the display in different ways to examine a particular circuit condition LM-3 is supplied with a 40 conductor ribbon cable terminated with 40 coded easy clips that fit on to the circuit pin test point breakpoint or bus line combination being tested and 40 discrete LED s on front panel indicate the logic state of each input High speed high impedance logic state indicators are linked with a selectable threshold control that can be adjusted for any logic family and positive/negative supply voltage input impedance is 0 5 MOhms at 6pF and the instrument works at up to 5 MHz and can capture 100 ns events Four operating modes run or normal mode rating mode where display follows data until a rising or falling edge appears at the trigger input and then latches until the next selected edge appears and a latch mode where display follows input until the instruments arm button is depressed when the next trigger input will latch the display In addition both rating and latch modes can be used with a manual pushbutton Three logic threshold selection methods are provided fixed +2 2V d c threshold for logic operating at standard TTl levels variable threshold (-5V to +10V d c) with front panel control and a test point for accurate monitoring and a supply dependent threshold (70% of the operating voltage of the circuit under test) is sampled via dual front panel connectors £290 plus VAT **Engineers, Labs.**

NATIONAL SEMICONDUCTOR

DM10414 high speed 256 bit bipolar emitter coupled logic RAM Accesses data in 12 nanoseconds max 7 ns typical Typical chip select time 3 ns 16 bit Cerdip package Fairchild 10414 and Motorola 10142 ECL RAM compatible Unterminated emitter follower output allowing wired OR interconnects for multiple RAM arrays Output uses a 50 ohm resistor to a 2V supply to provide a low at the output when the device is off Separate data in and non inverted data out pins are provided Operational over 0 to 75 °Celsius requires supply voltage of 5 2 ±5% volts and draws 150 milliamps max In addition National Semiconductor has introduced a new 8 bit microcomputer NSC 800 Fabricated in double poly CMOS (p^2CMOS) NSC 800 incorporates architectural features of existing microprocessors with enhancements for ease of use Capable of 1 microsecond instruction cycle times while dissipating only 5% of the power consumed by comparable NMOS processors 40 pin multiplexed address/data bus structure of 8085 register structure and instruction set of Z80 Two dedicated peripherals – NSC 810 RAM I/O timer and NSC 830 ROM I/O also fabricated in p^2CMOS are available to provide memory and general programmable interfacing capabilities In particular they incorporate on chip logic to interface directly with the multiplexed bus A minimum three-chip system requiring no interface

The LM 3 40 channel triggerable logic monitor from CSC components would incorporate 2 KBytes ROM 128 KBytes RAM two 16 byte binary timer/counters 5 interrupts and 32 I/O lines **OEMs**

RCA

CA3179G integrated circuit prescaler designed for use in digital frequency division and high frequency up conversion Can divide down from frequencies as high as 1 25GHz Operates from single +5V power supply power dissipation 325mW supplied in 14 lead dual-inline Gold chip hermetic package U H F (Division by 256) and V H F (division by 64) modes of operation Single or double-ended inputs usually a c coupled (d c if specified bias levels maintained) Sensitivity typically 15mV r m s at 900 MHz Output is complementary emitter coupled stage capable of driving 33pF or equivalent load Tested applications include digital frequency synthesis for V H F /U H F receivers satellite communications and instrumentation high frequency division for U H F frequency counters timers high speed computers frequency standards radar and communication systems and high frequency up-conversion **OEMs Labs**

Bureaux, Consultancies, Services, Shops

DaVINCI COMPUTERS LTD

Who have been in operation for over a year have opened a new shop premises in Edgware High St As PET specialists they will continue to provide their customers with application packages (Word Processing Stock Control and Invoicing Sales and Purchase Ledgers Incomplete Records Information Retrieval and Payroll) and hardware In addition aftersales service and maintenance on the hardware and software will be provided

FISHER-CLARK

Plain and printed self adhesive computer labels designed to customer specification can now be ordered through one of Fisher-Clarks national network of computer label stockists Labels can have special perforation cut outs or dry unlaminated stripe Various shapes sizes and materials (including self copying)

GEISCO LTD

INDUSTRIAL SIMULATION SYSTEM (ISS) developed by Special Analysis and Computing Services Inc (SACS) now available through GEISCO MARK III remote computing service Can substantially shorten plant start-up time by checking engineering designs examining possible operational problems and evaluating design changes A simulated pilot plant can subject designs to normal and abnormal operating conditions before they are finalised Trial and error investigations can be made on existing plants The package is user interactive and communicates in engineering terms directly into terminals linked by a local telephone call with the MARK III service Output in the form of a print out print plot or x-y plot is received within minutes Introduction of the service is part of a program by GEISCO to make state-of the-art software available to the oil industry through the MARK III network ISS input facilities provide extensive cross checking of data and allow different levels of operating skills The procedure to set up and execute a simulation is as follows (i) input all equipment and process data (ii) input of printing requirements or x y recording (iii) input of test data or disturbances to be imposed on the system (iv) input run control specifying run time print time and finish instructions Simulation interprets process and instrumentation diagrams as a superimposition of two networks process equipment connected by piping and instruments connected by wires or tubes The MARK III service is based on three computer super centres — two in USA and one in Netherlands — and remote communication links It is available 24 hours a day seven days a week and is used by over 6 000 companies in 25 countries **Engineers**

HSV LTD

Has opened a Computer Centre and Demonstration Showroom in Southampton (22 Southampton St (0703) 22131) This purpose built facility will provide a full range of computing services from microcomputers for personal use small/medium businesses scientific and educational requirements to full bureau services and the Computermail range of automatic mailing systems 3 Microcomputers are offered — Commodore PET ACT Series 800 and ADDS System 75 Bureau service includes data prep with floppy disc card or magnetic tape output, PIPS phone in payroll service operating on overnight turn round and the Compact 8 range of accounting services — ledger payroll and management information Computermail services include Computaddress microprocessor based address file compiler Variaddress computer labelling equipment and Zipaddress automatic sort equipment

JETLEY'S FILING SYSTEMS LTD

Program Binder High capacity allows program and notes to be kept separately although in same binder Red polypropylene secures up to 4 (over 1000 pages) of print out Secured in depth up to 12 of 15 5 18 and 14½ widths Special punching to order Print out is held tightly by means of grip clips and nylon posts in a channelled spine and there is easy acess for front and back loading Two white opaque plastic divider sheets are included Facing the print out program notes are held in a transfer arch Printed narrative lead sheet is provided Integral tabs on each side of the binder allow it to be edge indexed labels being provided

MICROCOMPUTER ADVISORY SERVICE

Independent impartial advice concerning microcomputers for small business or the professional practice who has little or no previous experience of computers covering initial consultation/report follow-up assistance systems and programming consultation and training

Exhibitions, Courses, Events

BRIGHTON POLYTECHNIC

(Short Courses Unit) in association with Delia Venables of the Microcomputer Advisory Service *Microprocessors Microcomputers and Word Processing* Three days of practical instruction which can be taken either as a complete course (£140) or as separate days (£55 each)

BRITISH COMPUTER SOCIETY

INTERNATIONAL CONFERENCE ON DATA BASES Organised jointly with Aberdeen University Department of Computing Science conference will take place in Aberdeen on *2 4 July 1980* Main aim is to stimulate research in databases as well as to provide a deeper understanding of current issues and future prospects by bringing together British researchers interested users and leading world experts emphasis will be placed in research work which has potential for implementation Guests include Charles Bachman of Honeywell Donald Chamberlin of IBM who is architect of SYSTEM R and Tom Steel Jnr of AT & T who will speak on the International Standards Organistion Report on data bases 13 other research papers will be given £97 for academics and students and £127 for non academics

BRITISH INSTITUTE OF MANAGEMENT FOUNDATION

Two day intensive Course *Getting to grips with mini and microcomputers* incorporating *Hands on experience 26 27 June 9 10 July 22 23 Sept 1980* Conference Suite Management House *7 8 Oct 1980* Manchester Business School Booth St West Manchester M15 6PB £250 or £270 plus VAT Also *Micros The real costs how to fund them* one day practical conference *8 July 1980* Mount Royal Hotel Bryanston St London W1 £85 or £95 plus VAT

CMG COMPUTER MANAGEMENT GROUP

Series of shared consultants teach ins and documentation enabling the smaller businessman to carry out his own investigation and selection of suitable comuter systems £46 per person CMG Southern s teach ins will be held at the company s Croydon offices

COMPSTAT 1980

4th Symposium on Computational Statistics University of Edinburgh *18-22 August 1980* 72 papers have so far been selected for presentation and they will include reviews of current methodology and discussions of the most commonly used statistical packages as well as descriptions of recent research on new techniques and software An exhibition featuring the main statistical packages computational aids and microprocessors is also planned and participants will have the chance to test packages in a series of software demonstrations Details from Director Program Library Unit As Compstat coincides with the Edinburgh Festival accommodation is limited and interested parties are advised to book early

CONTROL DATA

Selling the Psychological Approach Working with Microprocessors Supervisory Success and *EXCEL* (See Brand News 7) are the first four courses to be offered at Control Data s PLATO learning centres in London Bristol Manchester and Birmingham PLATO provides individualised instruction at the terminal and also uses books audio and videotapes Students progress at their own pace and there are no formal class hours

DYNABYTE

BASIC CONTROLLER Seminar *9th June 1980* Grand Hotel Birmingham Features *Basic Controller* single board computer

BRAND NEWs

which is aimed at industrial laboratory control and educational applications. Course fee £20 plus VAT

EUROMICRO 80

Conference and Exhibition Imperial College London 16 18 September 1980 6th in annual series is the leading European Convention concerned with microprocessing and microprogramming It will attract delegates from many countries and provide an excellent opportunity to extend the applications of micro technology to potential users in every scientific and industrial sector Organised by Industrial Seminars Ltd and sponsored by The European Association for Microprocessing and Microprogramming

EUROPEAN STUDY CONFERENCES LTD

Computer Information Systems and the Legal Profession one day conference *18th June* Carlton Tower Hotel London SW1 Intended to provide participants with up-to-date briefing on the nature extent and impact of computer based information systems on the administration and practice of law in the UK and to a lesser extent in the EEC Details from Mrs Anna D Alton Fee £90 plus VAT

ICFC MANAGEMENT STUDIES CENTRE

Five courses on *How to Automate the Office Data Processing Computers Successful First Time Use 12th June* Café Royal London *Word Processing Workshop 1 Overview for Managers 23 June* Café Royal London *Word Processing Workshop 2 Preparation and Planning for Word Processing 24 June* Café Royal London *Word Processing Workshop 3 Implementations of Word Processing Systems 25 June* Café Royal London *Word Processing for Supervisors* 3-day Course *10 12 June 2 4 July* Waldorf Hotel London

ICFC TRAINING AND MANAGEMENT CONSULTANTS LTD

Seminar *Should we be Using a Computer? Tuesday 17th June 1980* London Chamber of Commerce of Industry 69 Cannon St London EC4N 5AB £27 60 inc VAT Details from Miss C A Measures London Chamber of Commerce and Industry 01 248 4444

IPC

Next Viewdata Exhibition – retitled *The Viewdata Exhibition for Professional and Business People will be held on 29 31 October* at the West Centre Hotel London It is sponsored by the journal Viewdata and TV User and organised by IPC Exhibitions Ltd

LITTLE GENIUS

London based teaching systems software house computer based data processing courses for APPLE and ITT 2020 users Course allows users to learn Principles and practices of computer operation and how to make the most efficient use of a system with discs in a data processing environment Specifically the course deals with DOS 3 2 software Available direct or from micro computer retail shops £40 plus VAT

LIVINGSTON HIRE

Two Seminars organised in association with *Health and Safety at Work* magazine *Hazards at Work Measuring the Size of your Problem* Churchill Hotel London *20th June* and Excelsior Hotel Manchester *26th June* Fee £25 including lunch and documentation (Details from Baroness International P R) An Exhibition of 60 different types of equipment for measuring pollution dust noise temperature etc will run in conjunction with the Seminars Livingston Hire deal in the rental of such equipment and also offers a comprehensive Environmental Measurement Service

LONDON CHAMBER OF COMMERCE AND INDUSTRY

Seminar Computers and their Uses Hotel Lily next to Earl s Court *Business to Business* Exhibition *11th June* Further details from London Chamber of Commerce Public Affairs Unit Also Training Courses *Introduction to Computers and their Applications 16th July Introduction to Microcomputer Programming 11 12 June 1980* Details from Training Department

MICROFAX '80

Organised by Bancroft Hewitt Ltd a Conference and Exhibition on *Microprocessors and Microprocessor based equipment 15th and 18th July 1980* University of Manchester Institute of Science and Technology (UMIST) Aims to introduce in completely non technical language the fundamentals of microprocessors across a wide range of their applications

MSS COMPUTER AND BUSINESS CONSULTANCY LTD

Courses in *June* and *July* in Worthing *Computer Appreciation for Senior Executives June 9 10 Basic COBOL Programming June 9 13 Computer Oriented Production Control June 11 13 Accounting for non Accountants June 18 19* and *July 1 2 Project Management and Control in DP June 23 27 COBOL Programming for the Experience Programmer June 30 Computer Appreciation for Beginners July 1 2 Production Planning and Control July 1 4 Effective Costing Systems July 8 Computer Appreciation for Managers/Users July 10 11 Microprocessors Crash Course July 14 Word Processing in the Modern Office July 16-17*

ONLINE CONFERENCES

Networks 80 3 5 June 1980 Bloomsbury Centre Hotel London *IBM MVS 10-11 June* Marriott Hotel Amsterdam *Integrated Business Telecommunications 18 19 June* International Press Centre London *IBM VM/CMS 1 2 July* Sheraton Skyline Hotel London Airport *Future Systems 10 11 July* Royal Lancaster Hotel London *1980 Microcomputer Show 22 24 July* Wembley Conference Centre *Computer Graphics 80 13 15 August* Metropole Hotel Brighton *Systems for Small Companies 9 11 Sept* Cunard Hotel London

PORTSMOUTH POLYTECHNIC

Microprocessor Courses *First Steps in Microprocessors 2 4 July 1980* 3-day *Hands on* introductory course for engineers *Second Steps in Microprocessors 7 9 July* follow up to *First Steps Microprocessor System Design 10 11 14 15 July* 4-day intensive course deals with development of a microprocessor based product from conception to completed hardware *16-bit Microprocessors 17 18 July* 2-day course describes and contrasts TMS 9900 Z8000 M68000 M6809 and 8086 Details from Mrs A P Sizer Dept of Electrical and Electronic Engineering

RCA SYSTEM SERVICES

Two Seminars aimed at introducing design engineers to the field of microprocessors First will be held from *June 3 5* at Aldwark Manor a conference centre in The Vale of York The second is being arranged for the Autumn in the South of England Topics will include an introduction to microprocessors with a look at the CDP 1802 architecture and instruction set CDP 1800 devices and support systems COSMAC configurations and CDP 1804 features On the programming side the Seminar will cover development and techniques COSMAC programming examples and a practical demonstration

UNIVERSITY OF SALFORD

Computer Aided Classroom Instruction 3 day Course *15 17 July 1980* Aim of course is to enable school children to explore problems in science even if they have no knowledge of programming themselves Numerical and computational techniques will be described and participants will have opportunity to use and evaluate many of the microcomputers available A Teach yourself BASIC manual is available if required £27 00 Details from Administrative Assistant (Short Courses) [illegible] Reg[illegible]

Literature

ABACUS SOFTWARE

PET MACHINE LANGUAGE GUIDE Includes sections on using PET's input and output routines clocks and timers floating point fixed point and ASCII number conversion routines built in arithmetic functions – all from machine language programs Also suggestions for writing machine language programs and more than 30 of PET s built in routines fully detailed New and old ROMs covered $7 95 + *$2 00 Air Mail*

ACT

New edition of *ACT News* features new word processing system Wordcraft catalogue of software for the APPLE microcomputer talking calculator and ACT s recent purchase of an ICL 2900 series mainframe

EMI SE LABS

New full colour *brochure* of *2856 series of base band modems* Data speeds up to 19 200 bits/sec point to-point or multi drop configuration 4 or 2 wire full or half duplex

JORDAN's

Survey of Britain s Top 500 Electronic and Electrical Companies reveals that GEC remains No 1 for Sales and Profit with IBM (UK) moving into second place for profit and Thorn second for Sales Other information includes exports numbers of employees etc £40

MODEM COMPUTER SERVICES

Reviews 1000 job applications in the computer industry for the first three months of 1980 to determine going rates Survey will be updated every 3 months and distributed free of charge to anyone interested in recruitment of computer staff Cars and other perks are taken into account and report covers all levels of staff from operators to DPM

TRANSAM

Spring 1980 Catalogue of computer products

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CIS COBOL		£425
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WHITESMITHS LTD

C		£340
PASCAL (includes C)	not yet available	£500

RESEARCH MACHINES LTD.

ALGOL 60		£100

MT microSYSTEMS

PASCAL	Compiler	£185

VANGUARD SYSTEMS CORP

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tiny c	Interpreter	£50

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PL/I		£300

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BSTAM	(Byrom Software)	£80
SUPERSOFT	(Micropro)	£125
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MDBS		t b a
MICRO B+		£120
Z 80	Devt. Pkge with ZOT	£75
MAC	(Digital Research)	£55
ZSID	(Digital Research)	£50
DESPOOL	(Digital Research)	£30

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APPLICATIONS

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	Full Integrated System	£1250
MEDIAN TEC	Payroll	£500
ROGIS	Estate Agents system	£475
	Stock Control system	£475

WORD PROCESSING

MICROPRO	WORDSTAR	£250
	with Mail-Merge	£300
sba	MAGIC WAND	£200

ENGINEERING

MEDIAN TEC	Slope Stability Analysis	£500
	Portal Frame Plastic Analysis	£500
	Dec de Concrete Design pkge	£1500
	Finite Element Beam Analysis	£1500
ENG ANALYSIS	Truss force program	£35
	Structural Finite Element 2D	£50
	3D	£75

MISCELLANY

CP/M User Group Library	£7 per vol
STATISTICS pkge	£60 each
MATH FUNCTION pkge	£100 both
MICROSTAT STATISTICS	£150
SIMPLEX method LINEAR PROGRAMMING	£50
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GAMES PROGRAMS	p o a

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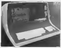

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William Collins

BRITISH MACHINE SPEAKS FOR THE DUMB

A British computer design engineer Chris Goss of Twickenham, Middlesex has developed a device which will enable the dumb to communicate without the use of sign language.

It can also be used by those who have temporarily lost their speech through a stroke or some other cause and can help stammerers and stutterers with their delivery.

Chris, who was recently (17.3.1980) the recipient of a £1 000 prize presented by the National Research Development Corporation at a function held at the Inn-on-the-Park Hotel, London, estimates the speech impaired population in Britain at around 100,000 which does not include the deaf who have speech problems.

He admitted there are already speech aids in being and mentioned the early Possum typewriter and the more recent Talking Brooch. But the Possum is more likely to be used by people with multiple handicaps who are unable to move around in a home environment and do not object to the fact that the Possum is mains powered, obtrusive and generally unportable.*

The Talking Brooch overcomes those two factors. Messages are typed in letter by letter and the visual display can be read by several people at a time from a reasonable distance. Also it is battery powered and very portable.

Mr Goss's device, however, is the first to use actual speech. It weighs about a pound (lb) and can be held and operated by one hand. The electronics and batteries are contained in a small case, about the size of a calculator, and may be kept in a pocket or attached to a belt. Connected to this unit are a small speaker, which may be fixed to a lapel, and a keyboard.

The keyboard employs a type of coding to select the words to be spoken, obtained by pressing buttons on the device. Having learnt the lettered code, which is quite simple, the keyboard needn't be looked at and face-to-face contact, a most desirable thing normally, can be maintained. That is not possible with the other aids mentioned as the eyes must leave the affected person's face to read the visual display.

To operate the keyboard, the user must be manually dextrous, literate, of average intelligence and have a strong motivation to find some means of communication which people with speech defects have, anyway. The keyboard consists of 12 keys laid out in four rows. Each row controls the word to be spoken. There is a vocabulary of 250 word-patterns which can fairly easily be extended to 500 words or 1 000. Mr Goss realised it would be unreasonable to expect a person to remember all 250 word-patterns and has found a way for easy and quick selection of a word.

The lettered-code is in itself unique. For example, 'ani' is enough for the word "animal" because Mr Goss has discovered no other words in the English language begin with those three letters. So nine of the keys are assigned letters. They are used to spell the word in its three letter code — that is, by pressing the keys 'a' 'n' and 'i'. Clearly not all the words in the vocabulary can be selected with those letters. So three of the keys are used to shift up to another level which will have a different set of letters. Some of the letters in this row may be the same as those in the previous row. If so, they appear in the same position.

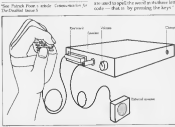
There are four different levels, each level being able to select 64 different words. Using this method, the user has to remember 36 positions. As some keys have the same letter, it will probably be less.

The whole unit is based around a very small, self-contained synthesiser with some additional circuitry. As Mr Goss had previously said, it allows the user to select from 225 words and phrases from a pre-stored vocabulary. Sentences may be formed by entering several words one after the other. The vocabulary has been chosen so that good grammatical sentences can be constructed as close to normal speech as possible. The sentences are spoken through the synthesiser in a clear intelligible voice. A repeat function is available so that an entire sentence can be repeated without having to enter it again.

Perhaps the most important part of the device is the synthesiser. It consists of a small microprocessor and a certain amount of memory containing the information about the words to be spoken. The data presented to the controller is used to determine the addresses needed by the ROM. Using this information, the synthesiser can determine how to speak the words, the correct pronunciation and how long it is. The speech input is then amplified and fed to the minute speaker which may be fixed, as previously mentioned, in the lapel of a garment say, or some other attachable place. With small adjustments, the device would work as well in a foreign language as it does in English. All that is called for is a person who speaks the language. It is then transformed into digital speech in the same way as English.

Modest Chris said he owed much to American pioneer speech devices which now provide standard synthesis boards but the purchaser must be capable of making up his or her own word code. The board provides for 64 words. Chris himself gets his boards from a Palo Alto, California supplier.

He has priced his device at the surprisingly low figure of £300. ■



The device – showing all the controls

▪ *The author is a correspondent of the BBC World Service Science Unit*

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*See Patrick Poon's article *Communication for The Disabled* Issue 5

Management **Cybernetics** **M. Saeed Sheikh**

A shop floor discussion at Pitney Bowes Limited

THE HELMSMAN

Part II:
The Language of Cybernetics

This series continues with a discussion of messages in goal-seeking systems. Book references were given in the first article (June issue)

In the previous article it was suggested that Wiener gave the greatest importance to the study of *messages* in our understanding of

- **conversation between persons**
- **a man instructing a machine**
- **a machine instructing a man**
- **a machine instructing another machine(s)**
- **a formal sub-system instructing another formal sub-system within the same organisation**
- **a formal system instructing another external formal system**

A familiar example comes to mind namely messages such as invoices and letters received daily by an organisation from external systems such as suppliers, customers, government agencies, financial and insurance institutions. These incoming messages arrive in the form of words symbols and numbers. They provide additional knowledge about the external environment with which the organisation interacts in order to achieve its goals for its smooth survival. The organisation also derives messages such as project control reports, decisions written or oral, weekly time sheets and various computer outputs from its own internal resources such as people and machines.

All messages are distributed through the internal communication channels to appropriate sub-systems in order to

- **transcribe them in the standard format**
- **record/store them in a suitable format**
- **filter them for generating further messages**

Thus both the internal and external messages (inputs) somehow get mixed up or merged during the various processing stages as stated above and culminate in new messages (output). These may be in the form of routine responses such as sales invoices payments to suppliers and income tax returns. These are then transmitted via various sub-systems information distribution channels to external systems. Some of these new messages remain within the organisation as they are normally 'instructions and commands' to direct and control problematic situations and decision-making.

The outputs (new messages) generate actions and from these the cycle of processing information repeats itself. This is shown in Figure 1.

We pursue the idea, implicit in the previous article that business organisations are goal seeking systems and a goal specification is largely dependent upon the amount and the accuracy of information that is available to us in the appropriate

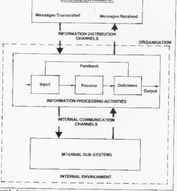

Figure 1 A general purpose model of information flows in a business communication system

time and place It follows that the key to

- the understanding of organisational behaviour
- the predictability of a system's responses to a given situation(s)
- the analysis and design of a system's structure
- the definition of objectives to be achieved

lies in the improvements of messages generated both internally and externally This in turn largely relies upon

- reception
- transformation (processing) and
- transmission

In the language of cybernetics these elements of a system is collectively known as a communication system'

Model of a communication system

A model is a simplified representation of a real life system which can be defined in terms of the purpose for which it is constructed However, in general a model attempts to

- identify the dominant features of a system under study
- the interactions between these features
- the effects of these interactions and relationships on the purpose for which the model is constructed

In cybernetic literature the model is usually the classical model of communication which was developed in information theory and which is most appropriate in tackling telecommunications engineering problems We shall not go into information theory as applied to business and management fields here but make use of some of its underlying concepts in our discussions

An example of a model of a human communication system is shown in Figure 2 In this example a policy decision is taken in the board-room concerning redundancy on the shop floor The personnel director who has participated in making this decision has to announce this policy to employees concerned through their trade union(s) officials Here the message is policy decision on redundancy' The message is generated in the board-room (source) and transmitted to various people concerned (destination) at three levels The cycle can repeat itself (as shown by arrows in Figure 2) in making some arrangements with all parties concerned in accepting, rejecting or amending this decision Let us now look at the three basic elements of a communication system

Reception of the message

The communication channels (various persons involved in this case) receive this message which may suffer from serious faults because

- it is presented in the inappropriate format
- it is not intelligible due to the jargon used
- it is distorted due to irrelevant detail, opinions and prejudices
- it contains conflicting data
- it is too short or too long and so on.

Processing of the message

After the message (information) is received and before a decision or decisions are taken the message has to be analysed converted into a format which facilitates understanding of its content and actions taken accordingly This may involve merging the incoming message with the information already stored in the memory and then producing a new message It may be that further information is generated in order to take any decision in response to the message received

The processing stage is complex, and may include the use of machines such as computers However at this stage the message may be subjected to distortion due to

- Misunderstanding the message and merging it with irrelevant information
- Uncertainty about the content of the message
- Opinions, prejudices and subjective judgements of both individuals and groups etc

Transmission of the message

The output of the processing activity of a communication system can be verbal, as in the case of an individual thinking about the message received and trying to make a decision in the light of known unknown and uncertain information Or it can be written The transmission involves issuing the instructions in some form Since these instructions are the output of the processing stage all the faults or biases which might have been included up to this stage of the communication system will be repeated at transmission The transmitted message may suffer further biases because

- An individual or a committee of people who have received a message may mis-

Level	Source (Sender)	Message	Receiver	Acting upon Message (Processing)	Destination (Receiver)
1	Board-room	Policy Decision on Redundancy	Personnel Director	Production of written or verbal message for announcing the policy concerned This announcement may be made in terms different from those used in the Board-room	Trade Union(s) Officials
2	Personnel Director	Policy Decision on Redundancy	Trade Union(s) Officials	Analysis conversion and interpretation of the content of the message received Message may be distorted due to many known and unknown factors such as uncertainty	Members of Trade Union(s) to be affected
3	Trade Union(s) Officials	Policy Decision on Redundancy	Members of Trade Union(s) to be affected	Analysis, conversion and interpretation of the content of message received Message may be distorted due to opinions and various prejudices.	Trade Union(s) Officials

Figure 2 An example of a human communication system model

expound arguments in dealing with it.

- **The situation(s) involved in it may be misperceived**
- **It may get wrong responses due to conflicting views and exaggerated facts**
- **It may be subjected to interference from the outside world, especially the media hence influencing the analysis conversion and interpretation of the message and so on**

This perspective of a communication system is oriented towards the managerial problems of understanding

- **the relationships between individuals**
- **the relationships between sub-systems within an organisation**
- **the relationships between the organisation as a whole and external systems**

Also there is the question

- **how do these relationships affect the goal(s) of an organisation?**

It follows that the essence of communication is interaction which can be written or oral, as well as gestures or facial expressions The transmission of information from an individual group or system to another individual group or system is absolutely essential in any business and management system It is thus important to establish the quality and the amount of information which arrives at its destination through the various communication channels As has been indicated in the above example (Figure 2) the message may suffer a variety of harmful influences

What is communicated information?

Figure 2 illustrates the phenomena of communicating information and the problems arising in understanding it and making use of it for the purpose for which it is communicated Usually there is a real difference between the original information and the communicated information due to many reasons, some of which have been highlighted above Figure 3 is used here as an aid in understanding how we really communicate — whether we use or do not use some sort of artefacts as means of communication In this figure

Syntax is concerned with structural information and therefore describes how symbols letters and numbers should be used to form words and sentences Syntax is the formal aspect of a language used for transmitting the message Consider the following example

```
10 PRINT P = 101/3
```

This is a simple print statement written in BASIC Since zeros in this statement are not slashed the computer will not be able to distinguish between the letter O and the number zero (0) The relationships among numbers letters and symbols used in this BASIC statement are not in accordance with the formal rules of this language and hence the transmitted information is not the same as that intended

Semantics is concerned with the meaning of symbols letters and numbers used Its rules are intended to eliminate the possibility of ambiguity so that information about things is shared by the sender and the receiver and meaning is thereby conveyed

Consider for example an internal memorandum from the board room to the accounts manager instructing him to allow 5% discounts to regular customers This management decision is successfully transmitted as far as its syntax (grammar) is concerned but its intended meaning (semantics) is not clear This message can create a serious problem for the accounts manager, as it does not define the word "regular" One of my previous employers had several types of regular customers and they were allowed different rates of discounts In that particular business a message like this would be meaningless There is no ambiguity of language used for this message but it suffers from the semantics (meaning) of the word "regular" in this context Similar problems arise frequently in management situations

Pragmatics information is concerned with the *intended effect of the transmitted message* A message may be perfect in both structure (grammar) and semantics (meaning) but the intended effect is *not* what the sender *expected* A familiar example is the desperate message, "the Titanic is sinking" It is perfect in the aspects of syntax and semantics but the Titanic was supposed to be unsinkable, the receiver took the message as a joke Pragmatics applies to all forms of information communicated and the behaviour responses that are intended It includes all forms of communication such as watching television or reading a book and the total behavioural interaction between people (committees) In the business and management environment the concept of pragmatics enables an individual a group of persons and many groups of people to examine such questions as

- *How sensitive are the shareholders to the newly appointed managing director?*
- *How can a data processing manager exert his influence on the users in having his system accepted?*

At this point in our discussion it should be noted that the syntax semantics and pragmatics areas of communicated information are inter-related entities of a particular message For this reason, in Figure 3 these entities are put together in their order of priority, in order to emphasize that there must be a proper *structure* before there can be *intended meaning* which in turn enables the receiver to act upon the message in the way the sender *expects* It should also be noted that it is not the matter(s) to which particular transmitted information is related that is the subject of this discussion but the way we communicate information However so far, we have been interested in the quality of information so now let us look at the 'Technical' area in Figure 3

The technical area is concerned with how information is quantified and its rate of transformation measured This aspect of communicating information via telephone and remote computer terminals etc) is considered in Information Theory When a business management system uses a computer with remote access terminals, and faces problems of handling data on the lines, then the theory is directly applicable to the transmission of information along the lines However such problems are best handled by telecommunications specialists

■The discussion is continued and expanded in the next article

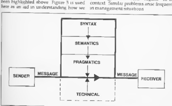

Figure 3 A conceptual model of communicated information

Any reader who is interested in telecommunication and computers should [illegible] the Data Communications Handbook published by Post Office and the National Computing Centre

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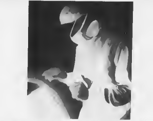

MEDICINE'S FRIEND

An advanced society is intricate and delicate Too heavy a burden on one sector can cause a collapse there or set up oscillations that can destroy its fabric. In medicine computers can lighten the burden.

It takes ten years at least to become any sort of doctor, a few years to become an experienced doctor, and possibly with any sort of inborn talent, a good or even a great doctor

By contrast a machine — the computer — can be programmed to acquire the information possessed by even the most experienced medical man in far less time And what s more the computer, a mere machine (or because it is a mere machine) will not forget It can instantly recall all this programmed knowledge something few doctors, if any can promise to do

Computers already assist with, and improve on the tasks of patient care and protection diagnosis of disease, clinic administration, financial functions and saving lives And this in some respects more efficiently cheaply and (frequently) with greater certainty of success than can doctors, nurses and other ancillary hospital staff alone

How much help the computer is can only be appreciated when looking at what numbers of patients are actually involved Hospitals may have as many as 1.500 to 2 000 in patients, but on any given day there may be twice that number of outpatients each one a special case

But it is not only the numbers which together present an all but insurmountable obstacle when computers are not used and where there are not enough staff Illnesses do not only vary in type but also in degree and danger And different patients may react entirely differently to the same disease Resistance to disease and injury differs from person to person, depending on the general condition of the patient, his or her family history, eating habits, work, age, sex and in some instances even race The computer can easily record all these facts and more

Medicines prescribed may vary on different days during given periods in quantity as well as in type They may also produce certain changes – some signalling improvements others deterioration All this can be recorded on a computer and immediately enable an even not fully trained nurse or hospital assistant to take vital action quickly action varying from summoning better trained help to taking what may be life-saving decisions, foretelling and anticipating possibilities based on other case histories keeping patients conscious and saving their lives

Computer information does not only aid nurses and other ancillary hospital staff but also doctors and highly trained specialists Thus for example a computer terminal will instantly display to the doctor on his rounds everything necessary to assess the patient s condition and what must be done if anything – for instance, the time that has elapsed since an operation, the amount of blood lost, allergies the patient suffers from, what medicines the patient is being given at the moment, in what quantity and how often These data may be all-important to correct diagnosis and treatment, yet may not all be familiar to the doctor, even if he has seen the patient before

It may seem that this information could, far from helping patients, endanger their lives in some way if people receiving it are unable to interpret the information correctly But computers can be programmed so that the information will only go to those authorised Presented with a nurse s identity card it will only disclose as much information as may be of use to the nurse The same applies other to other staff Thus an orderly confronted by a patient with the symptoms of a heart attack, may be ordered by the computer, on presenting his identity, to merely telephone for help A staff nurse may get the same order, plus advice to give certain treatmant the computer 'knows' she is capable of

Computers help to increase staff capability without impairing efficiency and patient care A nurse may have to sit with seriously ill patients in an intensive care unit and watch every move every change in the patient s condition twenty four hours a day With the help of a computer this is no longer quite necessary Thus, instead of watching one patient in the intensive care unit, the nurse may sit in a control room watching over five to six patients

The computer checks the patients' pulse blood pressure breathing rate, as well as the quality' of the heart beat To make doubly sure of reducing human error visual signals are supplemented by audible ones If the nurse does not notice any irregularity in a patient's heart beat, the computer sounds a bell to attract the nurse s attention

Can computers help make medicine cheaper? The question seems contradictory For it is a fact the cost of medical care has risen, astronomically in most developed countries But the undeniable increase in health costs has little to do with the increased medical use of computers but plenty to do with rising standards and public expectations

Take Sweden whose health service, the

world's best may yet be its ruin. If present trends in health care continue, every Swedish girl would have to become a nurse by 1985 and the entire national budget would be used up in that same year. However important the needs of the sick, that would be a catastrophe.

Nor is there any reason to suppose that conditions differ greatly in the UK. The signs are there: lengthening queues for operations and NHS treatment, lowered standards and discontent about pay and conditions among health workers.

And the answer is not entirely greater reliance on private health services, as some political pundits would have us believe — though such measures may give short-term relief.

The unsurprising long term answer is of course reliance, both in the public and private medicine, on technological progress and here the computer can and must play a major part. We need a revolution in attitudes.

The computer can be invaluable in a general practitioner's surgery. For after the doctor checks the screen which shows the patient's medical history, he can go a step further. He can "ask" the computer what may be the underlying cause of certain symptoms and the best way to treat and cure the patient. By consulting the computer, he makes use of specialised knowledge and makes sure of up-to date information — no doctor can be expert in every field.

Introduction

The computer can help in diagnosing disease on further levels, decreasing the possibility of error and increasing the speed of diagnosis. True, speed kills in some directions, but here speed can spell the difference between life and death.

There is a higher (though future) level to computer aided medicine. If, for example, a doctor is not quite sure of his patient's symptoms and his own computer does not have the necessary answers, it becomes possible to "plug in" on the information of a central computer. This will come up first of all with a list of further questions. These further clarify the patient's condition. The doctor now "plugs" his computer to that of the hospital for an appointment with a consultant. The hospital computer will then seek out a time and date for the appointment, report back to the doctor, and print an appointment slip for the patient. The computer will inform the hospital staff concerned, and of course, the consultant, of the time and date of the patient's arrival, and the purpose of the examination.

> *'The answer is not entirely greater reliance on private health services'*

The consultant's own terminal will show everything else necessary for him to know about the patient. If the patient is admitted to hospital, his details are available to the hospital computer — and so to the particular ward, its staff and doctors. They will be able to see on their terminals, what drugs will have to be and have been administered, and what effect they have on the patient.

The nurses' terminal will also show when the drugs should be administered and when these are to be made up by the hospital chemist, who might also have a terminal of his own.

In future computer link up would start locally, extend to large areas and finally cover the whole country and perhaps continents — enabling a medical history to be at a hospital's disposal instantly, wherever an ill person might be.

There may seem to be a great deal of optimism in talking about computer aided medicine, but computers are already working in some hospitals and health authorities. They could be installed and not just for administration. The technical know-how is already available, even if perhaps there are not many personnel trained to run a computerised health service. But will the government take a long range view and make the investment necessary? ■

Kurt Fleischmann is a science writer who has written for United Nations publications.

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Neurosurgical Intensive Care

This may be the best news for the National Health Service in a very long time

A computer system in an intensive care ward is still something of a rarity Indeed it might be argued that computers have nothing to offer in an environment which depends on the application of highly developed medical and nursing skills In fact a significant contribution can be made especially in these times of financial restraint by releasing those skills to be used most efficiently and to their greatest effect

When a patient is admitted to an intensive care ward his condition must be monitored precisely and at frequent intervals Data comes from several sources and includes electrical signals from the body itself and from life support equipment pressure and temperature measurements and assays of the many components of body fluids All parameters are recorded and changes must be quickly detected correlated and then corrected usually according to well established rules of treatment The process could be summarised as

- **1 Data logging and pre processing (including artefact rejection)**
- **2. Trend analysis**
- **3 Cross-correlation and probability analysis**
- **4 Application of decision tables leading to therapy**
- **5 Updating of data files for recall at any time**

Computers can of course give valuable assistance in all these areas and there is no doubt that in time computer systems will be widely used in intensive care units

In the special case of a patient who has received a serious head injury the primary objective is to detect any evidence of further bleeding inside the head, or swelling of the injured brain Either of these occurences will increase the pressure inside the skull which is in effect a closed vessel This pressure is the *intracranial pressure* (ICP) and if it is allowed to rise the heart is unable to pump blood against it and the brain becomes starved of oxygen The result is brain damage far more serious than that caused by the injury itself and it is this 'second injury' that is entirely preventable in an intensive care ward equipped to routinely monitor ICP

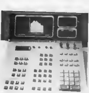

Fig 1 *The prototype terminal*

ICP is measured by a strain gauge transducer connected to a narrow plastic tube inserted through a small hole drilled in the skull The signal is normally amplified filtered and output on a chart recorder The trace often shows short and long term spontaneous fluctuations which make the measurement and trend analysis of ICP difficult As a result control of ICP may be poor Also since monitoring must be continuous for several days slow chart speeds are used and high frequency components in the signal are lost These components are potentially useful and it has been shown theoretically that they contain information which can provide warning of an impending ICP rise and so enable earlier more effective treatment

Four years ago the neurosurgical unit at Pinderfields Hospital in Wakefield purchased a PDP 11/5 minicomputer system with the aid of a grant from Action Research for the Crippled Child The aim was to overcome the limitations of conventional ICP monitoring and so to improve the management of severe head injuries The system was then the smallest of the PDP 11 minis and included 24K of 16 bit memory, dual 2 4MB disc cartridges a DEC writer III 30cps matrix printer plus analogue and digital I/O boards A VT 55 raster scan graphics terminal was added later, for installation at the central nurses station in the ward The operating system was DEC s excellent RT 11 real-time foregound background monitor System sub programs included a text editor macro assembler relocating linker BASIC and FORTRAN A subroutine library was included which gives access to monitor functions through FORTRAN calls and allows synchronous asynchronous and schedules routines to run as clock-driven or I/O-driven FORTRAN subprograms

Although no experienced programming staff were available it proved a relatively straightforward task to produce a software package for ICP monitoring (albeit the approach lacked some elegance!) The time critical jobs of signal conversion processing and filing were written in FORTRAN by a physicist and run in the *foreground* environment Routines for data retrieval display of results on the nurses terminal and production of reports were written in BASIC by a neurosurgeon, and run as swappable *background* jobs Fortunately, the structure of direct access disc files is common to both high-level languages

In the foregound program the pressure signal which is periodic at the heartbeat frequency and modulated by lower frequency components is sampled continuously at 50 samples per second The changes in pressure from beat to beat and within each beat are calculated and the means and distributions of these changes are stored on the data file every 15 minutes Thirty second means are passed to the background environment for the display of short term trends Also calculated is an index which is related to the elasticity or 'tightness' of the brain It is this index which for the first time provides, on line and in real time, the early warning system that had been theoretically predicted.

When the system was implemented the rules for giving the drugs which control ICP became much more simple and objective, a decision being made every 15 minutes and based on the time-averaged pressure mean and index. Since it was put into routine use over 100 patients have been monitored and a database of over 10,000 hours of ICP data accumulated.

In this basic form, however, the system was of only limited usefulness as it was only contributing to *half* the processes listed above. Although the ICP data could form the basis of the treatment decision it was not, by itself, sufficient. Many other aspects of a patient's condition can affect his ICP, or be affected by it. Even simple physical parameters such as turning or tilting the patient can alter the hydraulics of the measuring system and false high or low pressures can be recorded. When it came to retrospective analysis of treatment patterns in order to evaluate and improve methods of ICP control, our database was a tremendous step forwards from conventional pen recordings but, again, it was limited when divorced from the rest of the patients' physiological, nursing and treatment data.

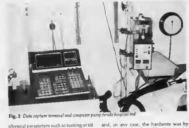

Fig. 2 *Data capture terminal and computer pump beside hospital bed*

Clearly, the system needed expansion and improvement. However, our basic software package, which was functional and had proved to be very robust, was extravagant and almost filled the available memory and so any additions would involve either the purchase of extra memory or the re-writing of the software in more efficient code. We had already rejected as unacceptable the use of multiple standard terminals for the input of nursing data and, in any case, the hardware was by now outdated and would not support a multi terminal operating system. Fortunately, the microprocessor revolution was now well under way and the solution to the system's limitations became apparent. By using *intelligent peripherals* for data capture and many other system improvements, the PDP 11 could be used for those tasks at which it excelled – real-time monitoring, scheduling, bulk data storage and retrieval and graphics displays.

It was soon obvious that no commercially available product would satisfy our requirements for a data capture terminal which could be installed at each bedside in the intensive care unit. During a patient's first days following a head injury up to 50 different parameters may be measured by the nurse, as often as every 30 minutes. Each measurement is normally entered on one of several charts. In order for a terminal system to be successful it must, at very least, cause the nurse no extra work and make the data no less accessible than the charts.

The prototype terminal, developed and built at Pinderfields Hospital, is shown in Figure 1. Every routinely measured parameter is assigned a single key on the keyboard. Depressing a key initiates entry of new data through the numeric keypad and also calls up a display of the previous 12 hours' data for that parameter. A separate key causes transfer of all current parameter data to the PDP 11 for storage, together with the on line ICP data, on the patient's data file. Combined parameter displays, or displays of periods longer than 12 hours can be called on the VT 55 terminal.

The keyboard, which is colour-coded, the display panel, combining a c r t with digital l e d.s , and the overall operational sequence were designed by the Department of Human Sciences at the University of Loughborough, who collaborated closely with medical and nursing staff on the ward.

The terminal contains an Acorn Computers Ltd 6502 Eurocard system with 8K memory and Teletext format VDU card. Software has been developed in machine code and is stored on a 2716 EPROM. A second EPROM contains display scaling factors and text strings.

Communication with the PDP 11 is through a parallel-line bus which is daisy-chained to each bed position in the ward. The video monitor is a 7" Visionpack from Digivision Ltd, producing a high quality display at relatively low cost. The total hardware cost for a single terminal is approximately £500.

One feature of the terminal is that data for any parameter need only be entered if it has changed between successive measurements, so that in the situation where a patient is physiologically stable, very few key depressions are necessary and significant savings in nursing time are possible.

Having given the PDP 11 access to all the relevant patient data, it now became feasible to transfer the treatment decision making process completely to the computer, and to put the administration of drugs for lowering ICP under direct computer control. Technically this became possible within the constraints of our system with the availability of remotely-controlled intravenous infusion pumps containing a microprocessor programmed with all the safety features necessary for the method to be medically acceptable.

The pumps were developed by IMED

Fig. 3 *system messages on VT 55 terminal*

Ltd in collaboration with Dr Louis Sheppard an American bio engineer working on closed loop control of blood pressure in patients following open-heart surgery They had not previously been used outside the United States, or for the treatment of head injuries Two pumps were bought with a Regional Health Authority research grant to be used for the administration of two different drugs to a single patient Communication between the pumps and the PDP 11 is along an RS-232 serial line the pump output drivers being TRI-STATE to permit bussing of several separately addressable units

The communications protocol is rigid and requires verification by both computers before a message in either direction is accepted Twelve status and error flags are available to the host computer together with three read/write registers related to infusion rate the volume of drug to be infused and the volume of drug actually infused at real time The pump automatically switches to manual control if potentially hazardous conditions are detected

Figure 2 shows the data capture terminal and computer pump at the bedside with the system in operation ICP control is reviewed every 15 minutes on the basis of the results from the monitoring program Pump status is checked every 30 seconds The dosage of drugs depends on several factors including the mean, the differential and the integral of ICP and index also, a learning process ensures that doses are 'tuned' to the needs of the individual patient Most importantly weighting factors, treatment thresholds and treatment limits can all be set by the consultant responsible for the patient's care

System messages are output to the VT-55 terminal (Figure 3) and the nurse is not normally required to take any action other than to replace empty drug containers, when prompted The system has been in operation since February 1980 and it is hoped to be able to show an optimisation of ICP control and savings in both nursing time and drug usage

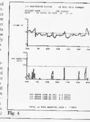
Fig 4

The replacement of nursing charts by data capture terminals has meant that a high quality hard copy preferably in graphical form must be produced for patients records Similarly the actual quantities of drugs administered by the automatic system must be recorded In line with the policy of using intelligent peripherals to minimise the program load on the central computer, a Diablo 1650 daisy wheel printer with firmware graphics and word processing options has been added to the system Data summaries are printed each morning by a scheduled subroutine or on demand The example in Figure 4 shows the dosage of one drug (Mannitol) which had been given by the computer in response to ICP changes, over a 24-hour period

So far as future plans for the system are concerned the immediate objective is to produce a data capture terminal for each bed in the intensive care ward and to extend the use of the terminals to all categories of patients We are fortunate enough to have a brand new intensive care ward now nearing completion into which computer monitoring facilities have been fully integrated and we believe that this will not be the exception but the pattern, as we move into the Computer Age ■

John Mason is a Senior Physicist at Pinderfields General Hospital Aberford Road Wakefield West Yorkshire

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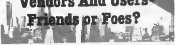
Vendors And Users—Friends or Foes?



The great American statesman and philosopher Benjamin Franklin remarked that we must all hang together or assuredly we shall all hang separately '' The year was 1776 the event the signing of the U S Declaration of Independence Despite the passage of time, Franklin's words still ring true for today's microcomputer users

From time to time all computer users need help from their machines Vendor But some users say that microcomputer vendors are not there when they need them Additionally they say, many vendors do not keep their customers informed of new product developments and changes For these, and other reasons, microcomputer user groups are springing up across the American landscape

Some of these user groups exist as information-dispersing organizations Others see themselves as problem-solving bodies Still others work in an adversary relation with the microcomputer manufacturers

Among the latter is a newly formed organization the International Microcomputer Association located in Colorado Springs, Colorado The new group says it will confront computer vendors with the complaints and problems of its members which it says, have traditionally been ignored by the companies

But if IMA is the microcomputer user's best friend there may not be much need for an enemy Although the group's founder says that IMA will arrange quantity equipment discounts for its members and publish a bimonthly newsletter in addition to fighting vendor unresponsiveness it seems that the group has done little to date other than collect its $25 registration fee To make matters worse, neither the group nor its founder, Robert M Simmons, has a listed telephone number in Colorado Springs nor do they answer either letters or telegrams

Perhaps a more satisfactory arrangement has already been discovered by many American microcomputer users – joining a *user group* User groups are generally organized by computer makers They usually exist only for the more popular machines such as Radio Shack (Tandy in Britain) Apple and Commodore computers

Although few user groups were specifically formed to wrest additional support from vendors this is exactly what some are presently doing "The microcomputer companies have got to bend over a lot further than they have so far says Jim Chladek leader of a PET users group in New York City As far as I m concerned he adds "Commodore can take our whole system back Our group has never gotten a full value – some of the equipment hasn t worked since the day it was bought

According to Chladek his group had problems getting service on its faulty equipment, particularly the disc drive and printer

Members of other user groups voice similar complaints When the system craps out " says Al Alexander a member of a Radio Shack (Tandy in Britain) users group you have to know what to do And that s when not if " Alexander says that the company usually provides adequate repairs from its service centers But he says carrying the machine to the store is a hardship especially when the computer is urgently needed

On the other hand there seem to be many user group members who are at least satisfied with the support they receive from vendors "Radio Shack is pretty responsive I d say they re fairly good, says George Saladino, Jr also a member of a Radio Shack users group "In the two and one half years that I ve owned a Radio Shack computer ' he adds, I haven t had any real problems with the company Saladino also notes that Radio Shack has recently supplied users with "lots of manuals and other instructional literature This he says, is a step in the right direction

Another cautiously contented microcomputer user is Ken Silverman an officer of the International Apple Core IAC is an international non-profit organization made up of Apple user groups from the U S , France, Ireland England, West Germany the Netherlands Australia Canada Japan and Venezuela According to Silverman, it now has 105 member clubs, representing some 20 000 users

With all those machines out there, he explains ' information dissemination was inadequate Maybe there s no way for a vendor to do it right They re in the business of putting out a product '

To fill this need, the group was formed last October IAC s stated goal is to 'spread the word' on software updates or hardware changes to all its members simultaneously 'In the past,' Silverman adds 'Apple users relied on the rumour mill for news There was a real need for an organization like this That's why Apple is helping us

Apple says it is also doing its share to keep its customers happy 'Our dealers ' says Lee Collings, "are the mainstay of our consumer base Collings is dealer support manager for the California-based company 'We provide our dealers with numerous training seminars as well as with an emergency telephone hot-line

Apple has about 700 dealers in the U S According to Collings about three-quarters of them are actively involved in the company s dealer training and assistance programs

One such dealer located in New York says that Apple has a good response to our needs and is usually very cooperative ' Apple recently bought out many of its distributors he adds and this has further improved dealer service

Another microcomputer vendor Commodore, once had a less than perfect reputation for user support But the company feels that it is working hard to improve Commodore now trains its dealers and also provides them with instructional literature The company is also trying to upgrade the quality of its dealer base According to Chuck Fowler Commodore's director of customer support 'When we get flak about a dealer, he s in a lot of hot water We've already weeded out quite a few

Fowler says that his company has been deficient in providing software documentation that is both thorough and comprehensible But now he says the company has launched a massive effort to clear this up 'We're constantly updating our documentation these days, he adds

Yet another vendor, Radio Shack also believes it is doing a good job aiding its microcomputer users

Radio Shack encourages local dealers to handle customer complaints and problems But it does publish a monthly user newsletter from its Texas headquarters It also provides users with a telephone hot line to handle special problems

Radio Shack has a policy of servicing its computers within 48 hours When users live or work near a dealer the company is able to adhere to this policy Otherwise the turnaround time can be a great deal longer

But according to Ed Juge director of computer marketing for Radio Shack these delays are unavoidable "If you live in the boondocks I defy you to get really fast service even from IBM he says If you let us charge $13 000 for our low-end computer things would be different This is a case of apples (!) and oranges ■

■ **Editor's Note** *The author's comments it must be emphasised relate to the American scene*

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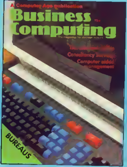

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MERCHANT DIES?

Our balancing act continues. Last May Derek Moon, Managing Director of Currys Microsystems, subsidiary of the powerful Currys retail chain, announced its entry into High Street computing. This month Martin Banks gives his view.

Just because someone, sometime, had the novel idea of selling these newfangled microcomputer systems from shops, there has ever since been on the lips of many the oft-quoted question "is it the same as selling hi fi equipment?" It has in the past been a question that prompted a range of grunts and furrowed brows from the knowledgeable, for they knew instinctively that the answer was "No", but had a sneaking suspicion that perhaps it *ought* to be "Yes".

Well, following the article by Derek Moon, managing director of Currys Microsystems, published in the May issue of *Computer Age*, it is a question that is soon to be put to the crucial test. Currys are moving in the business of selling microcomputer systems using the merchandising techniques the company has learned so well over the years selling such products as hi fi and washing machines. The outcome of this test is one that has to be of more than passing interest to both current and future purchasers of microcomputers. If it is successful, they will be the real winners. If, however, it is not successful, they could end up being losers twice over, for not only would Currys itself have disappeared as an outlet, but it may well have dismembered much of the existing distribution system in the process.

In his article, Derek Moon makes some interesting and *extremely* valid observations on the state of the microcomputer business in the UK. Yes, it is excessively dominated by the US manufacturers almost to the point of the total exclusion of UK manufacturing effort.

Yes, the Japanese presence is now becoming noticeable in the area of manufacture and the Japanese will make every effort to penetrate the microcomputer systems marketplace (and will probably be more than averagely successful at it). Lastly, the distribution side of the business in the UK is fragmented, does suffer terribly from over-concentration in some areas and under-concentration in others and, most of all, is drastically under-capitalised.

As Derek Moon points out, there are several similarities in the distribution business to the early days of selling hi fi equipment, with its jargon, elitism and almost secret society attitudes.

His answer to these problems is to employ the merchandising techniques Currys has developed over the years. This implies that the techniques of selling washing machines and hi fi can be successfully transferred to selling microcomputer systems. Given the overall state of the distribution business in the UK, it is theoretically possible to see why such techniques should work. There are, however, several practical reasons for suggesting that merchandising will not in fact work – for a few years yet, at least.

Take, for example, the already quoted hi fi question. Hi fi in fact is a rather good analogy for microcomputer systems, for it provides a simple systems solution to a user's problem, obtaining audio entertainment. There are broad similarities between the hardware of both, as they use high technology electronics, in often novel ways, and rely on the capabilities of the technology for their existence; they are both also just 'boxes', useless without their software. There are also theoretical similarities between the software for both. It is in this latter area, however, that the differences that go against merchandising micros appear.

The software (or more typically firmware) for hi fi systems is now very standardised. Within reason, virtually any cassette or record will play through any hardware system. These software packages can be purchased anywhere, and have become an ideal product for merchandising techniques. With microcomputer softwear, however, such a stage is several years away at least.

The micro industry is only just beginning to move out of the era of metaphorically hiring the Albert Hall, the London Philharmonic Orchestra and Johann Sebastian Bach, to perform a specially commissioned concerto that will be recorded onto a master disc made of pre-cast concrete that will play through a system running at 49⅞ revs per hour.

There is at last a little bit of standardisation creeping into software, but not much. Even the same standard can in fact offer a tolerance that is equivalent to, say, 28-37 rpm in hi fi systems. So far, the only real way round this is for users to select a manufacturer with as wide a range of compatible hardware and software as possible and stick to it come hell or high water. It is this that Commodore has successfully exploited, along with companies like Petsoft, and it is a route that several distributors have deemed sensible to follow. In such an under capitalised environment, it is arguably eminently sensible.

But to the user, this ends up the same as Henry Ford's famous "any colour so long as it's black" philosophy. As microcomputer systems are only solutions looking for user problems, this can end up like saying to a small business customer, "You can have any payroll suite you like so long as it's for ten employees." The customer can either hire some more or sack some to fit the system.

This is not a good basis from which to go merchandising products yet it represents a reasonable precis of the current software situation for microcomputer systems And software is now the key element in actually selling the beasts (just like records and cassettes with hi fi) One day it won t be like this There will be more standardisation, *real official standardisation*, of both hardware and software Programs will be transportable and readily available at tolerable prices Most of the bugs will be ironed out andthe users will exploit their capabilities and the technology behind them with the same attitude of mind now given to records and cassettes

One day it will happen Then will be the time to merchandise

There is another aspect of merchandising which is dubiously related to microcomputer selling The technique is based on the idea that, with an effective distribution network a large number of outlets can be supported and each can individually gain the benefits of bulk purchase An integral part of this, however is that it implicitly depends on selling those products that can be moved through the outlets with the minimum of time and effort therefore keeping costs down Together with the gains from bulk purchasing, these cost savings can then help the seller help the customer, by offering such facilities as finance leasing and the like without being itself financially crippled

Now washing machines TV sets, and hi fi equipment are eminently suitable candidates If an average salesman can close a sale on one of these in 15 minutes then it is unlikely that the customer is going to buy As the technical specifications are usually broadly similar, the major problems for the customer are style and the colour of the cabinet (OK so with hi fi it might take 30 minutes)

'It is this that Commodore has successfully exploited'

With microcomputer systems however the situation is often very different The poor customer has a problem to solve – probably several inter related ones It will take the seller some time to find out exactly what they are (most customer's don t actually define them to themselves that well before deciding to buy a system) It takes more time to work out a potential solution and then more time to actually define a configuration out of all the mutually exclusive options available that will actually do the job It all takes time and *that* takes most of the money And merchandising is nothing if it is not time and-money dependent

One last point culled from Derek Moon s article He mentions the excessive amount of technical jargon that appears in many current advertisements and suggests that this should be changed to more easily assimilated messages that stress the benefits of buying a system to the user This is fine in theory and certainly sound marketing Unfortunately however, because technology – any technology – throws up new concepts that cannot adequately be defined in common language jargon becomes the only practical way of stressing that technology's advantages and capabilities It is much more a case that the potential users have to be educated up rather than the technology sold down for that only masks both the real advantages and disadvantages

The education process, especially if merchandising is being attempted is probably even more important for the staff selling the computers than for the purchasers If the salesperson doesn t understand the intricacies of this very complex subject, there won t be many satisfied customers around, if there are any customers at all It already happens with equipment like washing machines There are several people who were not told at the time of purchase that a certain make only lasts for 350 wash cycles It doesn t sound as long as seven years which is the equivalent of one wash per week Use the machine more than that and well Use it every day and it won t last a year The point is did the salesperson actually know that fact at all, or understand its importance? ■

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John Bartram is a Creative Director, in charge of all film radio, print and press creativity/production, for an international advertising agency For the past nine years, he has worked in the Pacific region and the Far East He is presently based in London

As the media and electronics industry hail the micro-chip as the start of a Second Industrial Revolution the extent of its impact on our lives is being questioned A recent article in DESIGN, for example asked "How many times have we heard that microprocessors will bring the small computer into the living room enabling its proud owner to do his own accounts' on it? Too often The real market for personal computers doesn't work like this "

Although the media often carries features and advertisements on the video tape recorder (VTR), its penetration into the US, Japanese and British homes in less *than* 1% Home computers have penetrated even less far into British homes Why the discrepancy between the image and the fact, and what if anything, can be done to minimise it? The consumer sees the changes from video and computer tape to disks, and vacuum tubes to transistors to chips, a trend towards faster access to more information, available in a growing variety of forms He sees simplicity in a move from flick switches to dials and buttons, to touch control and on the horizon, voice control Prices tumble, with colour television sets having cost ten weeks' wages in 1970 and only three weeks' wages today

A time can be imagined, almost within reach where new techniques in information handling will enable entire libraries of books and films to be either stored in or transmitted to one small unit containing a powerful analytical capacity There is a combining of television, radio, telephone, home and central computers and satellite transmission * Soon, the point will be reached where there will be access to a whole world of information through a unit carried in a jacket pocket

Interior of Lion Microcomputer shop in London

The consumer watches this scene with either anticipation, puzzlement, cynicism or possibly, apprehension, as different systems and products race towards a point of union Why buy now? In a while, systems will be more unified, products more reliable adaptable, useful and better performing, and their operation more understandable All will be relatively cheaper

With so many reasons not to buy now, It is not surprising that so few high technology products have found their way into the mass market So who are the consumers?

The micro-computer enthusiast, as an example can be relied upon to try to buy the new product so long as its cost is not completely prohibitive Such consumers get a new product out of the workshop and into homes where it can be evaluated and seen Being less concerned with value for money, the enthusiast cannot be seen as a market leader

There are some whose desire for the prestige associated with a product outweighs that of value for money Few of the home owners of Prestel receivers or VTR's could justify the expense in terms of product usage or benefit, but if £650 to £1 000 is of no great concern, why not? Such spending habits are not representative of the mass market

Those prepared to pay for luxury and

Continued on p 73 ▶

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* See *C To The Power Of Three,* by Julian Allason *Issue 7*

Unique in concept - the home computer that grows as you do!

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£120 plus VAT and p&p. An outstanding personal computer kit

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The picture shown demonstrates mixed graphics and characters in three shades of grey provided by the Standard Atom.

The standard ATOM kit includes:
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The ATOM concept
Adding chips into sockets on the PCB allows you to progress in affordable steps to large scale expansion You can see from the specifications that the RAM can be increased to 12K allowing high resolution (256 x 192) graphics Two further ROM chips e g maths functions, can be added directly to the board giving a 16K capacity In addition to 5 I/O lines partly used by the cassette interface, an optional VIA device can provide varied I/O and timer functions and via a buffer device allow direct printer drive. An optional module provides red green and blue signals for colour An in-board connector strip takes the ATOM communications loop interface Any number of ATOMs may be linked to each other – or to a master system with mass storage/hard copy facility Interface with other ACORN cards is simplicity itself Any one ACORN card may be fitted internally
So you can see there are a vast number of modular options and additions available expanding with your ability and your budget.

The ATOM hardware includes:
●Memory from 2K to 12K RAM on board (up to 35K in case) ●8K to 16K ROM (two 4K additions) ●6502 processor ●Video Display allows high resolution (256 x 192) graphics and red green and blue output ●Cassette Interface – CUTS 300 baud ●Loudspeaker allows tone generation of any frequency ●Channel 36 UHF Modulator Output ●Bus output includes internal connections for Acorn Eurocard

The ATOM software includes:
●32-bit arithmetic (±2 000 000 000) ●High speed execution ●43 standard/extended BASIC commands ●Variable length strings (up to 256 characters) ●String manipulation functions ●27 32-bit integer variables ●27 additional arrays ●random number function ●PUT and GET byte ●WAIT command for timing ●DO UNTIL construction ●Logical operators (AND OR EX-OR) ●LINK to machine-code routines ● PLOT DRAW and MOVE.

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▶ *from page 71*

Home Computers

convenience regardless of price can set a trend that lends prestige to a product There are enough consumers who buy for prestige to support many products within a particular category, such as sound systems cars and timepieces A company that has a reasonable product, with a high price and up-market image may well beat the value for-money test

The mass consumer market lies with those who demand *value for money* Only after that criterion has been met — for luxury and essential products — do the frills become important For example reduce a personal computer to a product that is small easy to use, reliable, of benefit to all in the family and costing only a few pounds — and one has the hugely successful pocket calculator

The winning marketing strategy must therefore decide on which market to aim at up-market with a limited value but prestige product, the mass market with a value for money product, or somewhere between the two Positioning the product correctly is of critical importance to the success of the product launch

How well is this done? DESIGN again 'To put it bluntly IBM doesn't yet fully understand how to cajole the ironmonger on the corner into buying a computer' 'Different market segments different kinds of computer different designs It's as simple as that'

How have home computers fared in the marketplace? The sales figures appear at first glance to be impressive It is claimed that one major manufacturer has sold 250,000 units in the US a penetration of about 1% or 2 5% of all homes In Britain, this will be lower

The potential size of the home computer market is determined by the number of people who can justify the expenditure against the product benefits At this stage of product development, the micro's benefits are limited

A major limitation is language Having to learn a language in order to operate a product is a handicap that the home computer must overcome before it has a wide appeal Only a small percentage of the British have a working knowledge of a foreign language, so one should not expect people to learn a computer language in any great number

The type of job that a computer can do is limited by a number of factors Home computers are most suited at present to filing-type jobs, but how cost beneficial is a terminal in the kitchen compared to a set of cook books? Or a diary? Or an address book?

A computer can be a useful tool in its ability to process data, but one has to have the interest and time to collect and collate all the data before the computer can process it How many people have an interest pursued sufficiently, to have amassed quantities of suitably prepared data in order to fully utilise a computer? Probably not enough to build a mass market upon

Each of the product types have their own market segment, with an identifiable consumer profile In CAMPAIGN, Philip Kleinman, a judge in the Computer Advertisement of the Year contest organised in connection with Computermarket, is scathing about the "hopelessness of most of the entries selected by advertisers as their best" and saying that the advertisements would have been better designed by computers, he advises, 'In principle it should be easier to compose a relevant and interesting message when you know exactly to whom you're talking than when you're addressing the public at large'

MARKET INTELLIGENCE

EXPLOSIVE GROWTH IN SMALL COMPUTERS DURING 1979

UK Installations of general purpose computers costing less than £15 000 have leapt from 48 916 at the end of 1978 to 87,600 at the end of 1979 an increase of 78% The total value of these installations at end 1978 was £436 million an increase of 39% over the year

While 24 300 of these machines cost less than £1 000 therefore including hobbyist and domestic installation the largest single segment is 35 692 systems costing between £5 000 and £10 000 in business and professional use

These figures are drawn from volume 3 of Pedder Associates' UK Computer Installation Census Series 1979 80 – General Purpose Systems under £15 000 which has just been published

This volume lists all small general purpose computer models in use at the end of 1979 analysing them by manufacturer or supplier and average system value The report covers 245 computer models of which 174 are currently marketed from 109 manufacturers or main suppliers Installations are classified into 5 value brackets

under – £ 1 000
£ 1 000 – £ 2 499
£ 2 500 – £ 4 999
£ 5,000 – £ 9 999
£10 000 £14,999

Manufacturer/supplier market shares are shown for each value bracket both by number and by value of installed systems

Volume 3 on General Purpose Systems costing less than £15 000 is available from **Pedder Associates Ltd, 199 Westminster Bridge Road, London SE1 7UT** and costs £800 Volume 4 Large General Purpose Systems is also available in June 1980 at the same price

At the low-cost end of the market is a range of small, often kit-set models Suitable mainly for learning about microprocessors and with capacity severely limited by price/size, these tend to be manufactured by small companies with ambitions Its market is with the beginner/enthusiast Most people do not have the skills to construct the kit set and they are of little practical value in the home

The largest share of the home computer market is with the "table top" micro s such as PET TRS-80 and Apple 11 These are representative of the type of high technology product seen as spearheading the micro-chip revolution

The makers of micro-computers tend to give the impression that the only difference between their machines and main frames is price Micro's are advertised for business educational home and, sometimes, scientific use With BASIC as their common language these machines are projected as fast and easy to use The price tags shown range up from £350

The cost of the product puts it into the 'considered purchase' group for the mass market The consumer will therefore consider as much information as is necessary to make the decision on whether the product offers value for money or not

At this stage of market development the consumer will not be naturally aware of the product benefits and limitations Unlike the market for cars where he will have had a lifetime of experience to draw on, the consumer will probably not have any first-hand experience of micro-computers The number who have been trained in their use at school, university or office is still very small when seen as a percentage of the total number of homes

Responding to programs on television, and articles in the newspapers and magazines the consumer may decide to gather the information needed to make his considered decision An obvious place to start is at the local dealer outlet such as Tandy It is unlikely that he will enroll for a course costing his week's pay unless sponsored by someone who has already made a decision to purchase

Calling at a local Tandy Store, which is perhaps the most widespread and conveniently placed retail outlet a problem is faced Unlike their North American counterparts and in spite of ready accessibility to computer stock control only a very small proportion of Tandy products is likely to be in stock This places the consumer in the position of buying blind, or not buying at all As this is a 'considered purchase', the general result is no sale

If still interested he may visit the country's heartland of computer/high technology consumer product retailers London's Tottenham Court Road/Charing Cross Road district There, one of three results is likely Either a quick hard sell without the advice being looked for, a leaflet or two to be picked up from a counter — which usually carries copies of the press advertisements that provoked the initial enquiry or he may be ignored

The result of seeking information from retail outlets is therefore often of little practical assistance to the 'considered purchase' decision maker At this point, the consumer may well end the process

A small percentage who are keen enough to press for further information and demonstration will contact the manufacturer or a consultant If the manufacturer has a dealer network it is possible to lose the sale by referring the enquiry to the dealer

It would appear that only by paying for the advice he needs either through a consultant or seminar is the consumer going to be sure of receiving the quality and quantity of decision-making material that is required for a considered purchase Such an investment implies at least a partial decision based on ignorance and optimism In this situation, the product is unlikely to have mass-market

Whether one accepts such a picture or not, certain elements are fact The micro-computer has not become a mass consumer product Many who do purchase are later disappointed with the results Many who have paid for advice have decided not to buy Lastly the general public is still largely ignorant of what a micro-computer is, what it can do and what costs are involved

Faced with a difficult marketing proposition, the industry must be hurt by dissatisfied customers This will mainly occur from overselling the product It destroys credibility for future models if product benefits are promised but not delivered

One is therefore drawn to the conclusion that no matter how much fun it may be pretending to captain the Starship Enterprise or how simple it is to keep a check on one s bank balance the average home is not now prepared to finance a micro-computer

Looking at the positive side of each of the marketing and communication challenges much can be done to successfully place a well-designed product in the marketplace The commercial success of some companies to date proves that point

Home Computers

The makers of a micro-computer will know within broad parameters, the limits of their machines as well as its uses The price must then be not only profitable but offer good value for those uses

'There are some whose desira for tha prestige associated with a product outwaighs that of value for money.'

Knowing who can find value in the product is the first step in defining the target groups — who to aim your message at Aim slightly up-market of your target group a prestige image will only help a 'considered purchase of the product, the consumer will want to reach a little above himself, and it is easier to lower an image than raise it

Discover what qualities the product has that finds greatest appeal to the consumer and express it in the advertisements in a concrete and interesting way Ask what it is that needs to be considered in the decision-making process then make sure that the sales literature answers these questions Write everything in simple language and address yourself directly to the consumer rather than the vague "mass-market"

Make sure that dealers are well stocked and that demonstration models of all items for sale are available If rental terms, or hire purchase can be provided make that a selling point

Remember thet "the medium is the message" A hobby magazine is suitable for advertising to the hobbyist not businessmen and housewives, so the text must fit the editorial Thet may sound elementary yet machines are regularly advertised as suitable for everyone, then placed in specialist media Similarly machines of more general interest are almost never seen in general interest publications, whilst many types which may appaal to the enthusiast are never seen in their magazines Knowing your target group, media selection should be a simple matter

Lastly, the failure rate of new products in any category is high So must be the investment in launching it The result in a new industry is that many companies do not survive more than a few years A shotgun marketing strategy is an inaccurate and expansive method thet risks failure Adoption of a sound marketing and advertising policy, thet treats the consumer with respect, is far more likely to succeed in bringing about a Second Industrial Revolution ■

A SELECTION OF MICROCOMPUTERS

This selection is of necessity arbitrarily small as there are very many systems on the market Inclusion here does not imply endorsement As there are numerous dealers addresses are not given Systems marked with an asterisk can be looked up in the Guide to advertisers in this or in previous issues

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*OHIO SCIENTIFIC SUPERBOARD II 6502 4K RAM Assembler games	£298
*ROSTRONICS ZPLUS Z80 32 64K RAM dual 8" floppys (1MB) BASIC FORTRAN COBOL Pascal Business Systems	£4000
*RESEARCH MACHINES 380-Z Z80A 16 56K RAM optional cassette or floppy BASIC Assembler COBOL, FORTRAN ALGOL educational/scientific applications	£830

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To Scan Or Not To Scan

The history of computer systems is a replacement and extension of cash register equipment has been a curious and haphazard affair that continues to baffle shopkeepers and computer experts alike

Many companies have taken to supplying retail systems for shops and supermarkets Of these organisations five are ex-cash register manufacturers the rest being suppliers of computers and electronic office equipment During the 15 years that computerised retail systems have been in operation a very significant proportion of the participants on the scene have given up in desperation for producing such systems is a costly business The most conspicuous casualties were Pitney Bowes and Bunker Ramo Singer was transformed after being bought by ICL, and during transition from mechanical to electronic machine production the British form Gross ran into such financial difficulties that it nearly disappeared from the scene before being bought by Chubb The German company Anker went into liquidation three times before being bought by a Swiss finance company, and the changes in the technology compelled NCR to make a large proportion of its work force redundant Manufacturing systems for shops is not an easy business

On the other side of the fence many retailers feel that the computer industry has continuously failed to meet their requirements Instead the computer industry has imposed the developments of high technology on the retailer forcing changed selling methods to suit the system rather than designing the system to suit the retailer

This problem has been particularly obvious in supermarkets where the entire business of buying and selling is undergoing a radical change

Those of us who take more than a cursory look at the frozen food cabinet when planning the next meal may of late have noticed a curious little black and white symbol appearing on a number of items This innocuous little label, called a bar code heralds a radical change in supermarket selling and packaging technology The bar code is a machine-readable symbol that will overcome any need for a cashier to 'key-in' details of goods or price in a supermarket Instead all supermarket and high turnover products such as cigarettes toothpaste and magazines will be scanned by a laser beam at the cash desk the cashier's task being significantly reduced He/she will merely arrange the goods on a moving band and establish the opening and closing of a transaction all other calculations being computed by a terminal at the "point of sale"

Already this revolutionary change in supermarket selling techniques has been adopted in the United States although the name of the bar code – the Universal Product Code – is not a good indication of its acceptability and use

What are the advantages of such a scheme? The major benefit is thought to be

5 012345 678900

This is a sample of an EAN bar code the symbol marking which is a printed representation of an article number It takes the form of a series of bars and spaces of varying width to a pre determined structure and standard The symbol can be read by low intensity laser scanners and other electronic scanning devices such as light pens in the area of goods labelling. Every supermarket, under the present arrangements, spends thousands of pounds simply labelling products for the cashier to record at the point-of-sale. Bar coding, which is carried out at the *source* of packaging operations, identifies the product for the supermarket and therefore overcomes the need for labelling in the shop.

In the future, the purchaser in the supermarket will see the price of the product on the shelf only, not on the item. At the cash desk, now transformed into a laser slot scanning terminal unit, the assistant will empty the basket, ensuring that items will slide past a laser scanning slot capable of recording the product bought by reading the bar code. The terminal at the point-of sale will have a price look up capability so that the unique bar code on every item will be cross-referenced with its price. If there is a special offer of half price, or a free item offered with multiple sales, the system will also compute this automatically. At the end of the transaction the customer is provided with a complete information sales slip, far more detailed than the receipt handed to the customer after traditional cash registration.

The new-style receipt will list the product in full, its size or quantity and the price, possibly even specifying the manufacturer. What are the advantages of slot scanning to the *customer*? The production of the complete and detailed sales slip of all items bought is very useful, but if this paper is mislaid, the customer has no record of the prices paid for items after the moment of removing an item from the supermarket shelf. Furthermore, there have been inevitable cases of incorrect coding of items in the supermarket, and this has given rise to occasional dissatisfaction.

The price coding is handled on a small controlling minicomputer in the back-office of the manager, and is, in general, a simple procedure that can be changed at short notice.

[illegible] have been [illegible] on bar coding their cereal range [illegible] consists of 26 different retail packs and represent [illegible] per cent of their turnover. They anticipate that [illegible] will be coded by the middle of 1981. Non cereal product bar coding will be completed by the end of 1981.

Bar Coding

One supermarket in Copenhagen, one of the first in Europe to adopt laser slot scanning, noted an unexpected benefit through introduction of the system. Here it was observed that the relationship between the customer and the cashier had been radically brought back to life, for the business of merely laying products out is hardly taxing, and consequently a certain human element previously missing in supermarket shopping is restored. For this reason some elderly shoppers, who were expected to reject the idea of the new technology, found it preferable to conventional cash registration methods.

For supermarket managers the business of bar coding is a costly exercise. A laser slot scanner is not cheap, and there is always a risk of losing customers who may resent a change in shopping methods. The introduction of such systems has had a mixed reception in the United States, a cautionary factor in view of the fact that slot scanning has been operational there for six years. Also it presents some problems to packaging organisations that are compelled to reproduce the bar code symbol to specific standards in order to ensure that accurate reading is facilitated.

At present an unimpressive number of laser slot scanning systems are in use. Of the 34,000 recorded supermarkets in the United States only 1,472 were reported to be using scanning equipment at the beginning of this year. This cannot be viewed as a raging success over six years. Nevertheless optimistic sources envisage that this figure might well double by the end of this year.

European figures for scanning systems are even less impressive despite pioneering work on the part of such independent bodies as the Article Number Association of the United Kingdom. This educational institute for retailers provides full details about the requirements and implications involved in slot scanning. It is also an advisory body for the manufacturers of the equipment concerned.

In the United Kingdom there are between three and five slot scanning installations currently operational, whilst Germany has around 15, Holland two and Italy five. Other installations are also reported to be operating in Belgium and Japan.

These figures are necessarily approximate as retailers are experimenting with pilot installations all the time. Sainsbury are currently introducing experimental pilot systems to establish the value of the new technology. The first system which recently went into operation was a pilot system to establish the value of the new technology. The first sytsem which recently went into operation was a pilot IBM system. This will be followed later in the year by a pilot NCR system. (Tesco's also plan to have bar coding in its stores – **Editor.**)

Is slot scanning here to stay? The system is far from new, but its acceptance has been sufficiently gradual to give rise to other possibilities, and there is little doubt that should an alternative to slot scanning emerge within the next two years it could well displace this technology.

Four years ago the NCR Corporation went to considerable lengths to introduce the idea of slot scanning to consumer organisations and publications. The company's tentative efforts were met with some curiousity, but an essentially calm and unenthusiastic reception. Today IBM, who are equally involved in exploiting the technology, has taken even greater pains to bring slot scanning to the public's attention. It has done this by installing a system at the new exhibition at the Science Museum – "The Challenge of the Chip". Here visitors can gain first hand the ideas behind slot scanning and its implications. The picture is, of necessity, somewhat one-sided, nevertheless the exhibit is of interest. As proof of IBM's dedication to the technology, one must observe that two of its employees are operating the scanning system every day of the exhibition, which will run for two years.

IBM is the major supplier of laser slot scanning systems in the United States, with 549 systems recorded at the beginning of the year and a 37 per cent share of the maket. NCR comes a close second with 539 installations and 36 per cent of the market. The rest of the market is met by such organisations as Datachecker, Sweda, Data Terminal Systems and Univac, each with a very small percentage of the market. In Europe the pattern is bound to be different, as indigenous suppliers will strive to meet the needs of the supermarkets, and the Japanese, with the major share of the world market in electronic stand alone cash registers, promise to produce some systems solutions that could well solve some of the present inadequacies of laser slot scanning. ■

Anthea Ballam is a freelance journalist and writer.

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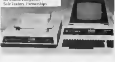

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CONVERSATIONAL LINEAR PROGRAMMING

The author describes his command-orientated linear programming and reporting system.

The first digital computers were developed for high-speed numeric processing, for military purposes. They were designed to compute ballistic trajectories, performing trigonometric calculations a great deal more quickly than was possible by hand calculation.

As the use of computers became more and more widespread, their functions diversified. Numeric processing, however, remains as one of the primary functions of the computer, encompassing all aspects of financial control, financial and non-financial modelling, measuring systems, process control, and the like.

The problems of processing numbers are threefold: data entry, data processing, and the meaningful output of the processed data. They are, of course, inter-related, and their magnitude is dependent on the type of data, and the complexity of the processing involved.

Data entry is accomplished under the control of a program, which may be very generalised software (a text editor, for example) or specialised for one particular application. Input of data falls into two classes: operator entry (e.g. by keyboard), and direct entry by measurement hardware. Problems may arise when the volume of data is large, causing input bottlenecks, when the data is ill-defined or not well-structured, or when parts of the data have limited validity or significance.

The operations to be performed on the numbers which have been input, *characterise* the processing system. In some applications the processing will be trivial; for example, the computation of payroll. The simplicity of such systems is because the calculations involved are well defined, they do not change from week to week, and more importantly, the data is totally structured. The fact that the processing itself is relatively simple (and by that I mean Fourier Transforms and complex regression are not involved!) is incidental.

In other cases, the precise nature of the calculations involved will not be known at the outset, and may depend on the *interpretation of intermediate results*. The problems are often compounded, particularly in experimental work, by the fact that the data is incomplete, and that part (or all!) of the data may be inaccurate. Programs are thus often necessary for the interpretation of results before work may be continued. In such cases, the user is faced with two choices regarding data processing and interpretation.

Firstly, there is the option of writing a program for *each* set of calculations. This has the great advantage that the user may specify exactly what he wishes to do with the data, and may choose the optimum format for the production of reports. It has the disadvantage, however, that it is very expensive in terms of time and resources. This may be offset to some extent by the fact that, as work progresses, the user will build up a library of frequently-used routines.

The second choice involves buying or writing a *package* which will cope with the majority of the processing involved on a conversational basis, and which may go some way towards helping to interpret the results. The most common application of such packages is financial modelling. There are several disadvantages associated with this solution. A problem arises when processing that is not catered for by the package, is called for. Enhancing such systems is often more difficult than programming the whole thing from scratch. Report formats are often unsatisfactory. The package will probably be highly specialised and therefore inflexible, and may cater only for data presented in a certain format.

Frequently, the data to be processed can be expressed in a tabular manner, that is to say, it can be put into rows and columns. An obvious example of this is financial performance data, for which figures are available at set intervals, for example, monthly. There may be a wide range of parameters available in this format, e.g. sales figures, overheads, wages. Scientific data can almost always be tabulated in this manner. In these cases, large numbers of similar calculations have to be performed. To return to our financial example, a manager may have to compute the ratio of profits to turnover, for each of twelve months in the year, to provide a management report.

A table of data organised by rows and columns is called an array, and the block manipulation of parts of the array, as in our financial ratio example above, is a subject of linear programming.

A few conversational linear programming packages are available, by means of which tabular data may be manipulated. An example of such a system is MINITAB, a huge FORTRAN package produced at the Pennsylvania State University. MINITAB is geared towards handling scientific data, and is not very flexible from the user's viewpoint. A system called VISICALC has appeared for the Apple microcomputer, which possesses some powerful features. It adopts a screen-editing (a little like word-processing) approach towards data manipulation, so that data may be entered directly into the table by means of positioning the input cursor to the corresponding place on the display screen. This facilitates data entry in some cases, but limits the degree of flexibility of the system.

At the University of Surrey, there was a need for a good conversational linear programming package for use by students of the department of Hotel, Catering and Tourism Management, in a financial case study. The package that emerged as a result, for which I was responsible for the design, programming, and implementation, is called SIMPLSTAT.

SIMPLSTAT is a command-orientated linear programming and reporting system. Its aims are to facilitate data entry and manipulation, to perform statistics functions to aid in the interpretation of results, and to enable users to produce meaningful optimally-formatted reports.

SIMPLSTAT maintains a table of 20 rows by 60 columns in the computer's memory. Specific rows and columns are referred to by identifiers prefixed with "R" and "C", e.g. R12 means row 12, C2 means column 2. Users may use the NAME command to define their own names for rows and columns, e.g.

```
COMMAND? NAME C1 JAN
COMMAND? NAME C2 FEB
COMMAND? NAME C3 MARCH
COMMAND? NAME R1 SALES
COMMAND? NAME R2 COSTS
COMMAND? NAME R3 PROFITS
```

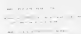
Data may be entered into the table by means of the INPUT command; for example the command INPUT SALES (1 12) will cause the system to prompt for SALES (row 1) data for columns 1 to 12,

```
COMMAND? INPUT SALES    12

SALES    JAN   ? 13542
SALES    FEB   ? 13468
SALES    MARCH ? 13718       P1
```

Existing data may be quickly edited by means of the EDIT command which enables a row or column to be scanned rapidly and particular entries to be changed at will

The LET command enables the user to perform block calculations on parts of the array. When SALES and COSTS data have been input, in the example above the user may issue the command

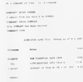


Reports may be produced by the PRINT statement e g

will produce a tabular report, with column headings JAN MARCH, MAY, JULY AUG SEPT OCT NOV, DEC Total of rows 1 to 10 (assuming that we have named columns 1 to 12 as months and Column 13 as Total) The array may be rotated to give reports columnated by row

Rows and columns may thus be referred to either by their default (R1 etc) or assigned (SALES etc) names The commands TAB and FORMAT exist for specifying detailed report formats, for example a template containing embedded commas and two decimal places may be selected, so that 12345 6 will be printed as 12,345 60 Titles or other informative text may be printed at the beginning or end of reports

Parts or all of SIMPLSTAT's array may be permanently recorded on magnetic disk, for later recall by means of FILE and ENTER commands e g



The file SUMMARY of rows 1 to 10 of the array will be stored on disk until the user decides to delete it. ENTERing the file, at any time will result in that data being recalled into rows 1 to 10 This does not affect the rest of the array (rows 11 to 20), so that tables may be segmented and selected parts recalled from disk For example, the Financial Times indices may be entered into rows 1 to 5, and specific company data into rows 6 to 15 Thus several files of company data may be loaded, one by one into rows 6-15 for comparison with the general indices in rows 1-5 Rows 16-20 could be used for comparisons between FT and company data

The command CATD above, causes a summary of all permanent disk data files to be printed

Essential to the philosophy of SIMPLSTAT is the fact that it will perform statistical calculations The user must firstly tell the system which part of the array is to be referenced by the statistics functions This is accomplished by means of the STAT command

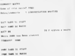
This sets the statistics 'pointer' to the row of SALES figures, from JAN to JUNE The command MEAN will then cause values for the mean total modes(s), median variance etc of these figures to be calculated and displayed Simple regression is possible via the REGN command REGN will cause SIMPLSTAT to perform Gaussian regression on the part of the array pointed to by the most recent STAT Command issued Regression is the process of trying to fit ideal curves through a set of figures

SIMPLSTAT uses seven curves (straight line, exponential curve power curve etc) to attempt to approximate the data, so that a model of the behaviour of the figures may be created The user is told how well each ideal curve approximates to the data in the array If one curve fits particularly well subsequent data will probably be on that curve so that a realistic prediction of future trends may be obtained This process of prediction is termed extrapolation SIMPLSTAT has a command called EXTRAP to do this

For example, suppose that SIMPLSTAT has told us that our SALES figures for JAN to JULY are approximated very well by a straight line (linear growth) We can now predict future sales figures as follows

The '1' means "use curve no 1 (a straight line) for extrapolation" and the '12', 'predict for 12 months (or periods) ahead SIMPLSTAT will compute the predicted sales figures for the coming 12 months (AUG to JULY-NEXT-YEAR) and insert this data into the array In this example we already knew the figures for AUG to DEC this year so that if our first 6 predicted figures agree with this data, we have further assurance that our predictions for next year are accurate These capabilities make SIMPLSTAT a powerful management planning tool

SIMPLSTAT possesses a very useful *macro* facility A macro is a sequence of commands which once typed in, and stored on disk, may subsequently be executed with a *single* user-defined command Frequently-used calculations or reports may thus be called up in a matter of seconds Macros are created by the command MACRO



By entering a full stop and the name of a macro the commands in that macro are performed Macros may call other macros, and may perform all of SIMPLSTAT's commands A macro could be written, for example to demand financial data for the current month to compute ratios and to perform comparisons with previous figures to file the new data on disk, and to produce a report for management predicting future trends in the light of the most recent data This could all be accomplished by means of one command

SIMPLSTAT has many other commands but those detailed above serve to provide an overview of the system SIMPLSTAT has proved popular with its users so far by virtue of its flexibility and adaptability to a wide range of applications The system runs on a PRIME minicomputer although a pilot system is running on a microcomputer, albeit in a highly non-optimised form The SIMPLSTAT concept is ideally suited for implementation on microcomputers, and would probably prove useful either as a stand-alone system, or as an adjunct to an existing numeric processing system

I foresee packages like SIMPLSTAT being used in two main areas as modelling tools and as report generators With respect to the latter application, the original specification for SIMPLSTAT called for the ability to produce high quality graphs and bar charts These features were not implemented, however, due to lack of memory on the minicomputer The SIMPLSTAT processing program is quite large, and with graphics and operating system would occupy most microcomputers memory space even without the data array One solution to this problem would be to implement a further 64KB of memory which could be referenced through I/O ports as a "super-array" This would cater for an array of over 100 rows by 100 columns, at 6-digit precision I am surprised that no one has produced an extension memory system of this type, to date If sufficient interest in SIMPLSTAT is generated I may just do this myself ■

Alistair Kay is a Research Fellow in microcomputers in business applications at the University of Surrey a microprocessor and microsystems consultant and a freelance systems designer The Visicalc package referred to is available from Personal Computers Limited, and Microsense and many Apple dealers

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HBC SOFTWARE ON THE CBM PET

New Book-keepers start here

You need a Sales Ledger to help you chase debtors for money They should of course pay without prompting on the invoice But because you are kind or think it will encourage regular customers to buy from you more often you allow them to have goods on tick and settle at the end of the month

Having been kind thus far, some people also give 2½% cash discount to these same customers to encourage them to pay Really you should charge them interest to recompense you for the cost of the money you have to be up in funding them till they pay — not less than one percent per month compound Any 2½% discount offer will certainly have to be a factor in deciding your mark up for a selling price

If you sue a customer for money you sue on the invoice The sales ledger system merely produces a statement of account to remind the customer (and you) how much to pay Amounts not paid from previous months' statements are highlighted to prod his conscience and his cheque book into action The Sales Ledger also serves as a record to tell you at any time the total value of the debtors

Arithmetic accuracy of the sales ledger is important otherwise you will not have the confidence in the system that you need to win arguments with recalcitrant debtors

At the same time as entering the invoice total into the ledger it is convenient to enter VAT amounts and to analyse the value of goods sold for sales statistics and for the end of year accounts of the business

New computer users start here

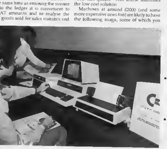
You can buy a computer with a cassette reader from your local store for £600 It will not help you with your sales ledger

For about £2000 you can buy a system with printer dual floppy discs and around 32K of memory At that price it will be a CBM Pet Apple Tandy Sharp, or one of the growing range of other well-advertised names You would be wise first to choose the exact computer program package you need *before* choosing the machine and to select your vendor with care so you are able to *discuss* your application with him take his *advice* rely on him for *help* A shop counter is likely to be too busy and too noisy a place for such a dialogue And by the time you have paid for the software and after sales support the bill is likely to be closer to £3000 than £2000

There are around 120 makes of micro computer Most cost around £7000 with a total budget including software etc of around £10 000 Only at around £12000 for the hardware do you get a pair of hard discs and multiple terminals with the software that goes with them You may not need this quality This article addresses the low cost solution

Machines at around £2000 (and some more expensive ones too) are likely to have the following snags, some of which you will only appreciate when you have used the system for a month or two You have been warned I will not be specific about particular machines if you find the cap fits you can wear it or buy elsewhere

- *Keyboard* — too small for your hands key tops wear off no facility for lower case characters What you really need is a keyboard as good as an IBM electric typewriter's
- *Display* — too small to see clearly or alternatively only 40 characters per line so that when you want to type in more than this the line wraps round to the next line in the middle of a word A worse fault the display goes blank while the processor does any calculation
- *Printer* — poor quality print lack of lower case characters prints only on treated paper no forms tractor or paper tray for continuous stationery so you lose alignment carriage not wide enough (most accountants seem to need 10 columns of figures plus description) An irritating little fault some printers cannot feed status signals back to the computer so the computer thinks it has printed an error report but in fact you forgot to turn on the power to the printer
- *Floppy discs* — lack of capacity a normal five inch floppy disc holds around 70 000 characters and you may find this too small The sums for calculating file capacity are sometimes quite complex but they should be set out very clearly in the program package user manual Double or quad density and double sided discs would seem to be more useful eight inch discs which start at 240 000 characters would be even better That is providing the package supports them Some discs are slow even by floppy standards users are blinded by the tremendous improvement in program loading time when compared to cassettes Even with floppies the designers could sometimes do better by smarter software to optimise sector reading for rotational delay or by reading several sectors at once into memory For example Computhink discs that do this take only 1½ minutes to copy compared with 5 minutes for CBM 3040 Eight inch discs are normally around the one minute mark plus a verify operation for another half minute
- *BASIC* — small BASIC interpreters are not compatible between machines even if you have the CP/M (tm) operating system which most don't Arithmetic accuracy is nine digits, which is fine unless you have big totals or lots of decimals or both Decimals will be truncated without warning Whole numbers go to exponential form which your readers won't understand either
- *Software* — low priced software is available to go with low priced hardware It still costs around £300 per package but to get to that low price a number of shortcuts are taken For example most authors try and get the whole system into one memory load of 32K the complexity of chaining or overlay of programs is expensive So if it won't go into



32K you cannot have it And to market to the widest range of users most authors optimise to the cheapest machine so it is not useful to buy a wider printer or a bigger display or even bigger discs unless the authors suppo t it And most packages seem to avoid sorting records into a more useful order since sort programs need a lot of memory if they are to sort quickly

- *After sales support* — low profit margins mean no or minimum after sales support and certainly no certainty of long term continuity of support You can get over this by only buying hardware and software with beautiful documentation so you can be independent and self sufficient

Never the less The low first cost ease of use simplicity sales appeal strong marketing and white heat of technological excitement means that you will buy these systems by the thousand *And you can live through these tiny problems*

HB Computers Ltd

The authors of this package have been in business for two years and are based in Kettering HBC are a subsidiary of Brikat Developments (Holdings) Ltd, who have Interests in Insurance Broking, Finance and Printing HBC contribution to group turnover is likely to be around £1 million this year They specialise in CBM ACT and Sharp computers

The computer arm is 12 strong, including three engineers They have delivered about 30 Sales Ledger packages to end users in the Kettering area and these seem to be happy with them 55 Pet dealers now have evaluation and demonstration kits installed HBC let me have one but because the office Pet was busy I went down the road to Advanced Management Systems Ltd in Moorfields EC2 and used a system there Subject to the usual problems of differences in the configuration which is why you should always buy from a dealer rather than by mail-order it all worked very well

Sales Ledger and Purchase Ledger are currently available Nominal Ledger is awaiting printing of the documentation before it is delivered An invoice package is being developed Sales Ledger and Purchase Ledger each costs £350 If you buy both at once the combined cost is £500

Ring HB Computers (0536-83922) and they will tell you the name of your nearest demonstration site

Hardware required

The software runs on a 32K CBM 3032 which is the Pet with a proper keyboard and optional separate cassette drive It needs an 80 character wide printer and either the CBM 3040 dual disc drive or the Computhink disc system The capacity of the system is a mix of name and address records or blocks of three transaction records per unit You can have more customers or more transactions in a month, not both

On one CBM 180K disc surface you can have for example 700 customers with 1920 transactions 500 with 2520 or 300 with 3120 The Computhink 200K disc surfaces can have 1000 customers with 2340 transactions or 700 with 3240 or 500 with 3840 The proportions between CBM and Computhink are not direct as the Computhink file layout has been optimised to take advantage of its greater data handling speed The second surface of the double sided disc option on Computhink drives is spare I guess it could be used for files if you speak to HBC nicely

How it comes

After reading the literature and the user manual demonstration and hands on practice can be arranged at the salesman s offices When you have a feel for what it does for you and want to buy then the salesman will order the software for your particular configuration and this will be put together for you by HBC according to the parameters you specify They will be willing to change the parameters for you if you need Besides being simple for you this is part of their anti piracy measures if an author cannot protect his software then everybody will take copies as they wish and the authors will get no income and go bankrupt and you will get no support and no more packages will be written

The parameters are

- name address telephone number telex number — to go on the top of the statements when they are printed
- highest account number running up sequentially from account number 2
- maximum number of transactions per month invoices and cash
- the valid range of nominal account analysis codes
- type of Pet printer and disc and if double density or double sided

If you want to use your own preprinted headed notepaper instead of the supplied continuous stationery you can specify this You can choose 8 or 11' paper You have an option to allow the system to insert the system date on the invoice when it is keyed in rather than individual dates for each invoice And you can have the "amount to pay" line highlighted on the statement

There are separate parameters for Purchase Ledger Most people seem to buy the purchase ledger as well The packages are very similar in construction but with different words The current lack of an invoice package is probably felt most by the salesmen who feel incomplete rather than by the users who anyway seem to prefer to write or type invoices in their own unique way

Sales Ledger comes on two five inch floppy discs You are advised in the manual to take copies of both before doing anything else Format and Copy programs are included in the package

You get a 30 page manual which has Polaroid photographs of each significant screen layout a full list of error conditions and some useful words of wisdom on computer operation It is difficult to go wrong even without the salesman to help you In two hours you can be more expert than the salesman

Menus of functions

The master Menu is displayed as soon as you mount the program disc There are a number of special month end functions and utility programs If you select any of the daily processing options the main program is loaded and you can then take out the program disc and keep it safely till required again

Master file set-up

Because HBC have customised the system for you there is no hassle about setting up the files You choose a number in the range from 2 to the upper limit you have specified and key in the customer details You can start at number 2 because number 1 is reserved for control purposes by the system You cannot go out of the specified range nor can you use letters or spaces in the number an error message will tell you off and invite you to try again The number is used directly by the system to address the data on the file

You will need to set up a manual card-index in alphabetical order so you can find the account numbers You do not get any help in doing this Some systems provide a name and address list but nearly all of them print the name records in the order they have been entered so their list is not awfully useful

Name Address and Postcode can be up to four lines each line not more than 30 characters and the total length not more than 85 characters No other information is required to set up the file The system will position the screen cursor at the appropriate place in the boxes appearing on the display screen to help you

Transaction entry

A second screen layout allows a common format for Invoices Credits Refunds, and a variety of payment methods Each is differentiated by the code you key into the ' reference' box

Keying in the account number gives immediate response of the name and address on the file for that number for visual verification Then you key in the reference and this governs the screen layout for the rest of the transaction data Any number, or letter or space combination except those to which specific meanings are attached, up to five characters is assumed to be an invoice If the first character is a ' C it is assumed to be a Credit RFND is a cash payment to the customer, posted to the account to reduce a credit balance CHQE CASH DISC TRAN B/CD, ACCS P/OS are different ways for the customer to pay Each type will be totalled separately on the daily and monthly lists of credits In case we have lost you these stand for Cheque Cash Discount allowed, Transfer Barclaycard Access Card Postal Order

If you spell these codes wrong then the system will not tell you (how can it?) it will merely treat it as an invoice and give you the invoice screen layout which may

Sales Ledger

give you a clue that something is amiss But you should always post transactions in batches add up a total manually for each batch, and later print daily listings and agree the totals entered Otherwise you will put mistakes into the system and there will be tears of distress

Incidentally when you do find a mistake on the file you take it out by issuing a Credit or a Transfer Or if you want to cancel a cash item then you enter a dummy invoice Both items will still appear on the end-of-month statement; life is tough if you are too ashamed of the mess then you can type it all out again by hand

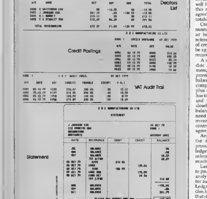
Values must be entered for each item complete with decimal point and two figures for pence No shortcuts are allowed This seems fussy, but on the Pet all the numbers and the decimal point are together on the numeric pad to the right of the keyboard Maximum value is 99 999 99 - so if you want to sell three Rolls Royces or two Lagondas on one invoice you have a problem

If you have opted to be allowed to put in an invoice data rather than just accept the system date you put in before you started the run, then a box is provided for you to enter thus DD MM YY The system will check the validity of the data including leap years If you now want to accept the system data then you can press Return and this will be done automatically

VAT is fussy You have to key in the Net Taxable Amount *and* the VAT Exempt Amount *and* the VAT, and each time putting in the decimal point and the pence The system helps you by providing suitable boxes, and positioning the cursor and by adding it up to equal the invoice total

Nominal analysis to expense codes is easier providing you have noted down the analysis on the invoice before you start Key in the appropriate code up to three digits numeric only and enter the amount for that code The system will add up the amounts as they are keyed and when the total equals the net amount of the invoice it automatically updates the lot to the nominal analysis totals on the file If it doesn't add up the system then takes you to each item in turn You can then accept each item as it is by pressing Return or you can alter it Note that if you later have to alter or cancel an invoice and you have neglected to note the analysis on the invoice, you are a bit stuck

Credit or cash items will prompt you to enter a month (three charecters) to show which month's transactions the item will be set against Pressing the Return key will cause the earliest month's transactions to be taken The ledger is Balance Forward not open item, but three past monthly balances are shown



Reports

There are five reports They are neatly headed dated with the today's system data totalled and the pages numbered VAT Audit Trail is the main day book and prints out Invoices Credit Notes and Refunds in the order in which posted mixed together but totalled to the three types You can tell them apart from the reference codes If you have entered them in batches like I said, then this is not a problem On each line VAT is identified as Taxable, Exempt and the VAT charged and is an adequate listing for the Excise (thus the name of the report) The VAT inspector will want to go back to the Invoices and Credit Notes the reference will help him find his way The totals of this report are designed so that you can agree them back to your manual prelist totals

Credit Postings Report is the second list, mixed together and in the order of posting as before and identified by data and reference Totals are shown by each type of credit posting These totals will need to be agreed back to the cash book and other records

A special program held on the program disc and accessed by the program disc menu as opposed to the daily menu will provide a list of active customers showing balances for 1, 2, and 3 monthe back and a computed balance for the current month, plus a total balance owing This program has to root about in the files to get the data, and for large files tends to run rather slowly This program will enable you to balance the books as often as you feel the need during the month, like weekly as a minimum You will need to keep a manual control account with the daily totals and agree the total balance owing with these

An Aged Debtors Report produced after the statements have been printed will provide an end-of-month check that the ledger is in balance, and provide a quick reference to those customers who are much overdue and should be chased

Lastly, at month end there is a program to print out the totals of VAT and Nominal analysis though the system is designed for automatic posting to the HBC Nominal Ledger system It really is a good idea to check through this report in detail to see that it is reasonable and that no errors have crept in For this reason it is a pity that no description of the nominal codes can be included in this report

Preprinted statement continuous

stationery is available from HBC HBC will build into your program the heading information so that the statements are neatly headed On the bottom line the amount to be paid is highlighted with an arrow The statement shows the analysis of the balance to the current month and two previous months Messages can be printed on the bottom of some or all the statements if you want to tell customers Happy Christmas, or whatever up to 3 lines of 65 characters

The second copy provided on the pre-printed stationery serves as a permanent file copy of the ledger As soon as each statement has been printed the detail is erased from the ledger file, leaving only the three monthly balances to start the next month You can stop and restart statement printing at the end of any required statement, just by keying the space key

If you want to run one or several statements mid-month then this can be done without erasing and updating balances At month end the manual recommends that you take a back up copy of the file before statement printing so that you can recover in the case that statements get spoilt in the printing

Enquiry

An abbreviated version of the customer statement can be displayed on the screen at any time This same screen image can also be printed Because the screen is only 40 characters wide both debit and credit items are shown in the same column merely identified by the reference

General Comments

Ease of use is the HBC Unique Sales Proposition Easy to learn easy to set up easy to run There are a number of very nice little features

For example, pressing * at any time stops the current operation with the files undamaged and returns you to the Menu And when numeric information is required to be keyed in then all the other keys are disabled If only one character is to be entered then you do not have to press Return If you have entered a full field then again Return is necessary

The manual is very readable There are sections on the utility programs provided FORMAT DIRECTORY DISCCOPY LOAD/RUN A very reasonable section on taking disc copies which may I fear not be enough to convince a first time user until after his first disaster There is a two-page expose of the problems when or if the mainfile overflows you need to run the statements early to reset the file, then send a copy of the discs back to HBC for them to reformat and copy across

There is a list of all the messages that will come up with further description of the action required This is fine for all the Sales Ledger functions But if the Pet misbehaves and tries to read a blank disc or a drive which has no disc in it then it hangs and you have to switch everything off and restart Normally the file is undamaged but it is a pain Nor is it easy to see a way the programmers could have gotten round this

The system uses Direct Addressing with two lots of chaining between records So there is a data chain to pull together the transactions for the day book And a customer chain to print enquiries and statements The most usual reason why you need a back up copy of the file is because something nasty gets into one of the chains and gives the 'Corrupted Account message So you have to get out the last back up copy and rekey the transactions since that time Tedious but hopefully not frequent

I have looked at the HBC package for a client with a limited budget who has 200 customers and about 350 invoices a month He hates book-keeping and though he does keep the books up to date he feels it is much more useful to be out there selling cars while the system is churning out the statements The package could obviously be used for greater volumes than this But don t push a small system too far ■

Richard Weller is the Manager of the mini com puter side at Spicer and Pegler Management Consultants

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Notice to readers! In Brand News (Issue 6 p52) there was an item on Fabritek Ltd as vendors of the GK7000 bubble memory terminal. This information was inadvertently included on the basis of an out-of date press release. Fabritek state that they do not market this item. We apologise to the many readers who contacted Fabritek

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INTERFACE

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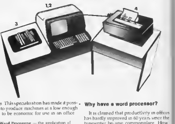
David J Salway CEng MIProdE, MIDPM is a Senior Consultant with Spicer and Pegler Management Consultants in London David is 45 and lives in Bedfordshire After an engineering apprenticeship he worked for many years in Work Study and O & M before becoming involved in computing in 1968 He has been both a Systems Manager and DP Manager and a Consultant for the past three years

The Word And The Machine



The written word is the most time-consuming means of communication in business and producing editing, reproducing and storing words on paper represents a major pert of the administration work of every enterprise

For many years now the typewriter has been the machine used to record words on paper This machine is designed to benefit the reader by producing a clean and legible document but for the producer is a labour intensive and increasingly expensive operation

A Word Processor is a machine which uses the power of a low cost computer attached to a typewriter to improve the efficiency of visually recording words The enormous potential of this development will lead to a new world for the processing of written communication This article will deal with what has so far been achieved Its aim is to

- describe the Word Processor and
- consider the factors involved in buying and installing a Word Processing system

What is word processing?

The invention of moveable type printing is regarded as a milestone in civilisation because it made it possible to reproduce a text for the rapid dissemination of written words to a wide audience The other benefit that is less obvious is that, because the operation of setting up type is seperate from printing the result correcting spelling errors rearranging words or phrases and formatting pages do not require the recreation of those parts that are *already* correct

In most office situations the multiple copying of text, much of which remains relevant for only a short period of time is less of a problem than the creation of a correct text *in the first place* A Word Processor designed for office work is geared more to deal with the requirements of typesetting than of printing

A Word Processor is a machine on which a print image can be created and manipulated before it is printed In order to do this effectively the machine uses computer technology which has, hitherto, been employed in the manipulation of numbers In practice there are a number of significant differences between data processing and word processing, so that although data processing computers are used for word processing it is more common to find specialised microcomputers incorporated into word processing systems This specialisation has made it possible to produce machines at a low enough cost to be economic for use in an office

Word Processing — the application of computer technology to the input storage merging, editing and printing of text

The earliest machines which could be called Word Processors were the Automatic Typewriters developed in the late 1930s and during the war years These machines stored standard text on punched paper tape allowing the insertion of variable information such as names and phrases where appropriate Magnetic tape soon replaced punched paper tape having the advantage of easier error correction In 1964 IBM introduced the Magnetic Tape Selectric Typewriter, MK1 and when a second memory was added it became possible to read text from one memory edit and write to the second memory before printing Small magnetic cards replaced magnetic tape and this was followed by the introduction of the visual display unit into the system providing an electronic display of the text, varying from one line of characters up to the display of a full A4 page of text on some machines

Today there are more than thirty suppliers of Word Processors in the UK alone and although the machines are based on a common principle the characteristics of the machines vary considerably and the purchaser must be very careful in choosing the machine must suited to the type of work for which it is required

Why have a word processor?

It is claimed that productivity in offices has hardly improved in 60 years since the typewriter became commonplace However the volume of text has increased many times over and now close on forty per cent of all work done in the western world is in the office The scarcity of experienced typists especially in large cities, has inflated wage rates, without a corresponding increase in productivity Similarly the establishment costs of employing secretarial staff is now very high and may easily add 50% to basic salaries

Word Processing aims to

- increase typist productivity by a factor of 2 to 5 depending on the mix of work done,
- improve the quality of typed output,
- reduce the level of skill required from the typist, reducing training costs

The elements

There are four basic elements common to all Word Processors

1. The display unit and input keyboard (the workstation)
2. The internal memory
3. The text storage media
4. The printer

(See illustration above)

Those familiar with computers will immediately recognise these as the same elements which form a computer system for data processing Each of these elements is examined below since there is a wide variation between different systems

The visual display and keyboard

The combination of the typewriter keyboard and the visual display unit is generally referred to as the 'Workstation'

The display screen plays a very important role in an efficient Word Processing system as it enables the typist to see the text that has been set up, without actually printing the text

Displays are of two types There is the cheap single line display which can show one line of text or there is the larger unit which can show up to a page

Word processing

The single-line display is satisfactory where only simple editing and format changes are required, as one would find in letters or reports of two or three pages

Where more complex revision of the text is necessary for example where tables of figures need to be included, or paragraphs moved about a number of lines of text must be viewed at once At present display screens are rarely large enough to show a complete page at a time, and various compromise methods are used to allow images to be moved on the screen as they are in microfilm readers The purchaser must therefore decide which compromise method is most acceptable to his needs

In examining keyboards it is important to note how control information to manipulate text is entered into the machine A variety of methods are available and the most suitable method will depend on the extent of editing required and the calibre of the typists being used

If the text contains a high proportion of numeric data then a keyboard with a separate numeric key-pad will be useful

The internal memory

Every word processor has an internal memory unit where the text is stored and manipulated This memory has two functions

- To hold that portion of the text being worked on
- To hold the program of instructions, in full or in part which control the machine and provide the text handling facilities

The space available in memory for text is normally not very large often sufficient to hold only one or two pages of text As the text is displayed further sections or pages are transferred into this memory area from the Text Storage Media The programs for the text handling will vary according to the extent of the editing and text handling facilities required The scope of these facilities is described later

The text storage media

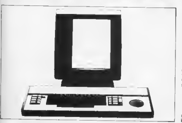
The system would be of little use if text could not be held on magnetic media and written or read at will There are four types of storage device commonly in use in Word Processing systems

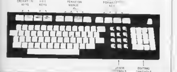
- The Floppy Disk or Diskette
- The Cassette Tape
- The Hard Disk
- The Magnetic Card

FLOPPY DISKS OR DISKETTES The most common medium is now the diskette, or floppy disk This can hold between 80 to 160 typical pages of text and the machine can rapidly access any required page Floppy disks are subject to wear but this is not such a serious disadvantage in Word Processing where usage is low Their slim size makes them easy to file

CASSETTE TAPES These are the cheapest magnetic recording medium, but are slow, and can only be read sequentially It may, therefore be necessary to read the whole tape to find a particular piece of text They are therefore more suited to applications where constant editing is not needed, such as in the preparation of standard letters

HARD DISKS Within the next few years small hard disks are likely to replace floppy disks in data processing, but their size and cost are likely to keep them unat-





lay types and a keyboard layout

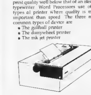
tractive for Word Processing in most office situations Hard disks are used on large systems where one disk may be shared by several workstations

MAGNETIC CARDS These can hold 3 to 5 pages of typical text They have many of the characteristics of diskettes but are now found on few machines

The printer

There is little gained in improving the input and editing of text to produce a well laid-out document, if the quality of the final print is poor The speed of printing is a key component in the overall productivity of the Word Processing system especially where one printer is used by two input workstations The printing devices developed for data processing are either line printers, producing large volumes of low quality text or matrix printers which are slower than line printers but still with a print quality well below that of an electric typewriter Word Processors use other types of printer where quality is more important than speed The three most common types of device are

- The golfball printer
- The daisywheel printer
- The ink jet printer



GOLFBALL The familiar golfball typewriter has been adapted for Word Processing output Limited to about 15 characters per second, this printer produces crisp, clear type and sets the standard by which other systems are judged The font is readily changed, the machine is robust and reliable

DAISYWHEEL PRINTER. The petal printer system is similar to the golfball in that the print head moves across the paper unlike a conventional typewriter where the carriage carries the paper across the printing position

The speed is around 45 to 55 characters per second and the print quality is very close to that of the golfball — many users would say it is as good Daisywheels are made of plastic or metal and are somewhat fragile!

The font is easily changed and special fonts are inexpensive

INK JET PRINTER The fastest high quality printer in wide use is the ink jet printer They operate at about 95 characters per second do not use carbon ribbon and the print font is controlled by electronic means instead of mechanically The quality of ink jet printing is not as high as the best daisywheel printers but is acceptable for most commercial use

General considerations

PAPER FEED The sprocket-fed continuous stationery used universally in data processing can be used but most applications will demand single sheets of paper without sprocket holes or perforations in a single station system the printer is alongside the typist and all paper handling can be done by the operator Where the printer is shared between workstations, remote from the operator, paper feeding equipment is necessary to feed individual sheets from a hopper

Apart from the technical characteristics of the individual pieces of equipment in a Word Processing system, the purchaser must also consider physiological factors These are

Heat — the machines can generate a noticeable amount of heat

Eyestrain — There has only been limited research into eyestrain caused by working at a visual display screen but experience suggests that continual exposure should be limited to no more than an hour at a time

Noise — All typing is noisy but the sustained noise of a moderately fast printer can be an irritant

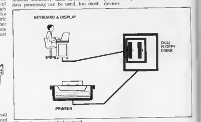
The systems divide into two main groups

- Stand alone
- Shared facilities

The choice as between a stand alone or shared facilities is very complex and many factors will influence the selection A full shared facilities system is unlikely to prove economic where less than five workstations are needed, although partial sharing with one printer sharing two workstations, each with their own diskette, can be advantageous It must also be noted that the more workstations sharing a single processor and disk system, the greater the impact of a breakdown

A further important consideration in selection is whether the stand alone systems chosen can form a part of a shared facilities system at a later stage and the original investment protected

STAND ALONE Word Processors evolved as stand alone single workstation machines and most installations are still of this type The system consists of one keyboard and display with the associated processor, printer and text storage devices



Floppy discs store text for later recall

SHARED FACILITIES Here several workstations are linked to a central disk unit and normally share a printer or printers The controlling processor may hold the word processing software this being known as a shared logic system, or each workstation may have its own copy of the controlling program within its own memory Some systems may utilise *local* diskettes together with a central disk store others may hold *all* text at the centre

The text editing facilities

The choice of word processor will be mainly dependent upon the facilities needed for error correction, editing, merging and substitution of text These features vary widely between machines and the facilities available on the lower price range machines which may have no visual display or a single line display are limited to error correction simple editing and features such as automatic centering of headings, underline and right-hand justification The full range of features, more correctly called *text editing* are associated with the screen based machines The main facilities are described below

Margin justification

Left and optionally right hand justification is provided and proportional spacing

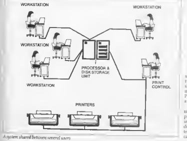
Word processing

between words is used to provide right hand justification on printing, if required

Error correcting and simple editing

All Word Processors are able to make corrections and erasures as typing proceeds by positioning the cursor at the word or line to be erased and pressing the erase key. The line and paragraph close up, and if insertion of other text is needed the operator can open up the line or paragraph and automatically close up again when the new text has been inserted. Other features include

- Automatic hyphenation
- Relocation of paragraphs in different sequence
- Pagination



A system shared between several users

Complex editing

Where more complex text switching and extraction is required, other facilities are provided on some Word Processors. These include

- Column switching to allow tabulations to be rearranged
- Reserving blocks of space so that a diagram or table all appears on one page
- Sort facility to put, for example, names into alphabetical order
- Selecting records so that a particular item of text can be chosen from a large record
- Arithmetic facility to perform simple calculations such as totalling columns and cross adding

Merging text and substitution

One of the earliest applications of Word Processing was to merge a file of names and addresses with selected standard text to produce "individually" written letters. All Word Processors can do this and allow a document to be generated by the author simply indicating to the typist the numbers or alphabetic reference to standard paragraphs held on magnetic media. This facility is of considerable value in insurance, legal work, shipping documentation and many similar businesses allowing standard clauses to be combined. The Word Processor pauses when a variable, such as a name, has to be inserted.

The other main feature is the ability of the Word Processor to search through the text for a word or string of characters, substituting a new string in place of the first at every occurrence found (for example insert 'Mary Smith' for 'William Brown').

Selecting a system

Selecting the best system is complex and should be preceded by a careful analysis of the work which is likely to be processed on the new equipment. At the same time it is essential to assess the *impact* of the introduction of Word Processing on everyone in the business.

It is essential to establish the facts by a survey which shows

- What text is processed — when and by whom?
- What do authors of text require?
- What do secretaries and typists need?
- What are the *future* work loads likely to be?

The survey

The survey should involve five stages

Stage 1 PRELIMINARIES. Setting objectives, designing the survey forms, carrying out a pre test of the forms, informing the staff of the purpose and scope of the survey. At this stage many fears and anxieties will be expressed as personnel want to know, "How will my job be affected by the Word Processors?"

Stage 2 DATA COLLECTION. Techniques most commonly used are to collect samples of each type of document, have each typist complete a survey sheet recording time and work details for a reference period of at least two weeks, use random activity sampling methods to determine existing levels of work and idle time, and most importantly, conduct interviews of authors and secretarial staff.

Stage 3 DATA ANALYSIS. Compile the facts and opinions into a set of tables from which reasonable conclusions can be made.

Stage 4 REPORT. Prepare a report for management setting out the findings and conclusions. This will include the scope of Word Processing, the type of facilities required and the type of system — stand alone or shared logic. Based upon the requirements established the report should include a cost/benefit analysis and a suggested plan for the introduction of Word Processing.

Stage 5 SELECTING A SUPPLIER. It is important to draft an invitation to tender in order that the purchaser and vendor are clear as to the facilities required. Selection criteria will depend on many factors including

- Price
- Level of after sale service
- Maintenance costs
- Ease of use
- Expandability where required
- Training support provided

If the number of Word Processing workstations envisaged is greater than one or two, a pilot Word Processing centre should be installed. The pilot scheme must be carefully monitored and Word Processing experience given to as many authors and typists as is practical.

A pilot scheme lasting up to six months is not too long, as this will give sufficient practical experience for the improvement in productivity, quality and speed of document turnround to be measured. The training support and engineering support can also be evaluated.

Using the supplier

Many vendors of Word Processing machines offer a free survey service prior to taking an order. These pre-sales studies are often motivated by the hope of an order rather than a search of facts. It should be remembered throughout that the emphasis of this type of survey will be on the benefits to be gained from introducing Word Processing, and in practice, the unique benefits to be gained from using the vendor's own equipment in particular! However, a vendor survey is better than none at all and if the relationship between vendor and the client is frank and open this approach can be usefully employed.

Using an independent consultant

Consultants are independent of any particular suppliers of Word Processing equipment and are skilled in the technique of survey and analysis. In this context the consultant can assist in

- Feasibility studies — surveying the firm's needs for Word Processing, establishing the most suitable configuration and facilities required and the cost justification or otherwise of investing in a Word Processing system

- Selecting the best supplier
- Assisting in the implementation of Word Processing and ensuring good working practices
- Assisting in the planning of the procedures. librarian functions and distribution of output
- Training both managers and authors in word processing techniques to obtain the best return on the investment in word processing

In carrying out the feasibility study, it is essential that the client is closely involved in the data collection and the personnel aspects, as the removal of the initial fears of the new technology is critical to successful implementation

Cost justification

Word Processors are not cheap prices ranging from £4 500 to £9 000 per stand alone system A large shared facilities configuration can cost £70,000 or more Based upon a four year write off of the capital cost, this indicates an annual charge of some £2,000/3,000 p a including maintenance for a single workstation

The productivity of a typist using a Word Processing system can be from 100% to 500% greater than one using an electric typewriter A city centre secretary now commands a salary of around £4 000 p a to which Social Security Pension Luncheon Vouchers and office establishment costs must be added, making the total cost at least £7 000 p a So long as the workload which can be transferred to the Word Processing system would otherwise require two fulltime typists, the investment will be cost justified

Word processing systems

The following analysis of three possible situations provides an indication of the type of installations applicable (See table)

	TYPE OF WORK	TYPE OF MACHINE	PRICE RANGE
1	Letters simple short reports and forms no tables of figures requiring frequent updating little editing of text.	Simple stand alone machines with thin window displays Floppy disk or cassette tape	£4 500 to £6 000 (keyboard unit printer media storage)
2.	More complex long reports tables of figures and diagrams in the text frequent editing extending to paragraph switching no large common files of text shared between users	Stand alone systems with at least 22 lines of text displayed Floppy disk media storage May be page or document orientated but document orientation preferred for long reports	£7 000 to £9 000* depending on level of text handling facilities and media storage offered
3	As in 2 above with the additional requirement to hold large files of text shared with many users or when the number of workstations is greater than five or six	Shared facilities systems with hard disk storage Printing may be centralised	£40 000 upwards

*CA Many small computers in the £1 500-£7 000 range also support word processing packages of varying degrees of sophistication.

Introducing the equipment

Following the selection of the equipment, the installation planning phase can be started This will involve

- Notifying the staff of the decisions taken
- Publicising the personnel policy to be adopted
- Selecting the Word Processing operators for training
- Preparing the installtion siting
- Ordering any special stationery
- Training authors and secretarial staff

Success in installing Word Processing equipment required involvement and cooperation of all those affected This is never achieved unless those directly involved are kept fully briefed on what is happening Keeping staff in the dark will generate insecurity leading to lack of interest or, in extreme cases lack of staff!

When selecting suitable operators it is essential that the aptitude and enthusiasm for new equipment prevails It is undesirable to recruit new typists with previous Word Processing experience, in preference to training your own staff The Word Processor has been designed to be used by the normal typist or secretary and all the computer jargon, which so bedevils data processing, has been removed Training is therefore straightforward, most typists being capable of learning the machine and producing useful work in half a day or less of instruction and practice, although it take about two months to become fully skilled and get the best from the equipment

The siting of the machine is not critical except for lighting, as glare from the screen must be avoided However, the location of the equipment in *relation to* the existing organisation and principal authors can be of major importance The increased output from a single workstation or the impact of shared facility systems require a review of the existing paper flows throughout the office to ensure that full advantage is taken of the new facilities

Finally, don't forget the authors need to be trained too! The temptation is to become sloppy about original drafting since changes are much easier on the Word Processor The danger is that constant revisions will absorb the capacity of the equipment resulting in purchases of additional workstations which are not really required

Future developments

Word processing is part of the information processing revolution which, together with data processing communications, intelligent copiers facsimile transmitters microfilm and databases, is introducing changes in all office work at an ever increasing pace It is difficult to predict where these developments will lead and social as well as economic considerations may dictate the speed of change It is, however, becoming apparent that the convergence of the three technologies of

- Word Processing
- Data Processing
- Electronic Communications

is taking place and will a major development factor

Word Processors had their birth in the computer technology revolution and the development of the microprocessor The larger computer manufacturers were initially slow to react to word processing and the specialist Word Processing vendors offering purpose built equipment have thirved However the large computer manufacturers now offer word processing software to be run on their EDP (Electronic Data Processing) systems and it is increasingly attractive to adopt this approach

Word Processing vendors too are alive to the need to provide typical data processing facilities on their machines such as mathematical packages and information retrieval software It is now possible to buy from several vendors word processing and data processing on a single *small machine* with files of data or text accessible to both types of processing This approach still has limitations but will probably develop very rapidly over the next few years as the technical problems are efficiently resolved

The suppliers will continue to improve Word Processors and extend the facilities of their equipment but the price is not likely to fall dramatically Word Processing is available now and, thoughtfully installed, will provide real benefits in most offices ■

Editor's Note New readers are referred to the article The Secretary: A Vanishing Breed? by Edward Hawthorne, which appeared in Issue 1

NEW TECHNOLOGY AND MANAGEMENT

BIM tackles the problems of awareness and action.

By special arrangement with the British Institute of Management we now have the BIM column as a regular feature in our magazine

Whatever else needs to be done to improve UK economic performance, British managements must rapidly adopt new technologies – particularly those based on microelectronics – to ensure that we stay in the race. Managers need to grasp the essentials of these new technologies, invest in them, and, with imaginative new approaches, gain the co-operation of employees and their representatives.

BIM's mission is not simply to exhort, but to help managers initiate action. The attack mounted over the past eighteen months has resulted in the unprecedented number of activities falling into four broad categories corresponding to the following needs: *awareness; basic skills; evaluation of working applications;* and *project-based action* ("The Search for Applications"). Repeated cycles of four awareness programmes – entitled MICROS – HOW TO USE THEM IN BUSINESS AND MANAGEMENT – concentrate on the general uses of Microprocessors, information handling, products and production, and word processing systems and people. These seminars incorporate case experiences and are highly participative. Their aims are practical – to encourage managers to scan their businesses for opportunities and to guide them on how to get started. (Next dates: 15-18 September London)

THE OFFICE OF THE FUTURE has now been mounted five times (Next date: 6 November London). This conference explores how Microcomputers, Wordprocessors, Electronic Mail and other developments can best be used. providing guidance on implementation, time is spent on the human applications of the integrated offices of the future, as fears of wholesale staff reductions and dislocation are often expressed.

In the parallel series ROBOTS AND THE FACTORY OF THE FUTURE (Next dates: 1 July - Manchester; 1 October - London) attention is again focused both on what industrial robots can achieve and on the people implications of their use. Freeing workers from dangerous tasks in hostile environments is one of the positive features, but fears arising from robotization will require new efforts towards working together and educating all the parties involved. Intelligent planning will be needed to avoid unnecessary dislocation and to bring about the rapid changes needed to survive.

The cost of new Microprocessor based equipment is greater than some will admit, and many are facing the question. 'How much will it cost and where can I get the money?' MICROS – THE REAL COSTS AND HOW TO FUND THEM seeks some of the answers (8 July - London)

> *'The cost of new microprocessor-based equipment is greater than some will admit'*

At first glance it seems surprising that, with the encouragement offered by the media and the government, so few British firms have opted to incorporate microelectronics into their products or production processes. Furthermore, the number of microcomputers or microprocessor based office products working in Britain appear low.

There is in fact good reason for this. The development of microprocessor products or production processes is often more costly than at first estimation. The cost which is to be incurred represents a drain on cash which – with a 17% minimum lending rate – is not only costly but often difficult to obtain. Thus even when good payback projects are available there is the question of where the initial cash comes from. The government will, under certain circumstances, supply some funding; but where will the firm find the rest?

This one-day conference will identify the areas on which money must be spent when a firm adopts micros. It will highlight the visible and invisible costs. After demonstrating how to determine whether one can afford to use micros, the conference will review what help can be expected from government – and how venture capital can be raised in the market.

Some of the most disorientated people – in the face of the widespread and rapid adoption of microcomputers – are D P specialists themselves.

Great advantage may be had from using microcomputers particularly in the data processing function where it can considerably enhance customer service. However, to do this successfully D P management has to take the lead in directing company policy towards micros. Unfortunately this direction has in many cases not been forthcoming, and consequently microcomputers are spreading piecemeal through many firms. According to *Computer Weekly*, 'One D P manager did a count around his organisation and discovered no fewer than 120 different micros.' This uncontrolled situation can lead to chaos.

This conference shows the major areas in which micros may be used and indicates how a sensible policy should be developed. These areas include decentralising processing, telecommunications, and integrated data and word processing.

To help non specialists grasp the basics and understand the principles of programming 'hands-on' practice with small computers is a feature of the very popular "GETTING TO GRIPS WITH MINI AND MICRO COMPUTERS" This 2-day programme dejargonizes the subject and helps managers form all disciplines understand and use computers A four-day residential version is planned for those needing greater depth (Next dates 26/27 June, 22/23 September - London, 9/10 July - Manchester)

STUDY MISSIONS – THE OFFICE AND FACTORY OF THE FUTURE, will travel to the USA and Japan from the Autumn, following an initial tour in June Visits to suppliers and users of some of the most advanced information and control systems – in both office and manufacturing contexts will feature in one week missions to New York and the Eastern United States

These tours will be specifically concerned with surveying some of the most recent developments in information and control systems, particularly using minis and micro computers

Present plans include visits to see

a) integrated information systems in use in major organisations such as the Chase Manhattan Bank and Exxon (the oil company of which the word processor firm VYDEC is a subsidiary)
b) Maceys (the large store which has point of sale equipment linked directly to stock control and to customers credit and bank accounts – electronic funds transfer)
c) major industrial users of shop floor control equipment
d) Wang headquarters and manufacturing plant at Boston and NCR New York headquarters

BIM

A special mailing list has been opened to ensure that details of the Autumn missions are sent to all those interested

A 12 day mission to Japan will tour three industrial centres to see industrial robots and related automation in action, and will cover some of the most advanced project work in the world

Action is the aim of all such activities – action by management to speed up the introduction of new methods

The final type of programme is specifically 'interventionist and designed to stimulate action within the given enterprise It is a diagnostic, in-company activity titled "CAN YOU USE A MICROPROCESSOR IN YOUR OPERATION?' and comprises four stages providing a basis for all managements keen to get things moving:

- 1 **FIELD WORK** to study the company's operations
- 2 **BRIEFING** on the likely areas for applications
- 3 **PROJECT WORK** ("The Search for Applications" – with guidance from checklists provided at the briefing)
- 4 **DEBRIEFING** workshop – to formulate action plans

For detailed brochures on any of these activities – or information and advice on the wide range of other programmes offered by BIM – contact Mike Stanley Head of Management Development and Training Services **British Institute of Management**, Parker Street London WC2 Telephone 01-405 3456

A further conference, lasting one day, which explains in practical terms how to use microcomputers as part of a Data Communications System, is being held on 2 July at the Kensington Close Hotel, Wright s Lane London W8 MICROCOMPUTERS AND COMMUNICATIONS is organised by **MCL** (First Floor South, Brettenham House, Lancaster Place, London WC2E 7EN Tel. 01 379 3574) on behalf of BIM and the IDPM Interested readers can contact MCL for a brochure and application form ■

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Tinker at your peril

Martin Healey (Packages — May 1980) suggests that software writers will not sell high-level source in order to protect investments Another reason not given sufficient attention is that of maintaining (i e debugging) modified software often without being made aware that modification has occurred

By and large object-code modifiers have more reason to take care against possible side effects and more reason to suspect *their* tinkering when the program *subsequently* malfunctions

A Billson (Director), MicroPeople Ltd , 1 Union Street, Long Eaton, Nottingham NG10 1HH

FORTRAN 77 & FORTRAN 7

I have read your issue No 6 with great interest I was very impressed with the concise overview of programming languages given by Lyndon Morgan except for one very important omission

He left the development of FORTRAN with the offshoot of BASIC in 1965 and made the perfectly valid criticism of FORTRAN 4 that it is (in many ways) outdated

However he does not mention the FORTRAN 77 standard which in our view brings FORTRAN right to the forefront of preferred languages for many applications We are using an enhanced version of this standard on the *TRI-NOVUM* processor

This implementation which is upwards compatible from FORTRAN 4 has the simplicity of use associated with BASIC having powerful interactive facilities full variable length string handling Formatted output (like print using) and sophisticated file handling (including ISAM with automatic record lock out for multi user environments) all within the language FORTRAN 7 which is the name of this compiler also has the structured block if capability which so many computer scientists today consider an absolute necessity in good programming techniques At the same time one has all the efficiency of a fully compiled highly optimised relocatable pure object code the ability to easily manipulate bits or arrays and even include in line macro assembler Above all from our own application development experience the most important advantage is the ease of building subroutine libraries which may then be used by simply passing parameters allowing our programmers to use building block techniques Incidentally the subroutines and functions may be used recursively

There is much more than space here allows which enamours us of FORTRAN 7 which we would be glad to pass on to any of your readers

Leo Schemer (Managing Director) C A R Business Systems Ltd , 71 Hammersmith Road, London W14 Telephone 01-602 4451
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Microcomputers In Primary Schools Project

We are starting work on a project designed to evaluate the use of microcomputers and the currently available software in primary schools in the area around this College

The project has been funded in part by the Department of Industry and to obtain the fullest benefit from the project we are having to approach industrial concerns for contributions in cash or kind

Through your columns we would like to ask any individuals or organisations who have appropriate software which they would like us to consider to forward copies to us

The results of our work will be published and made available to all primary schools in the U K

M Thorne, D Wharry University College Cardiff, Science Mathematics and Technology Centre, Department of Education University College, Senghennydd Road, Cardiff

Excellent marks

May I just write and express my views about the article by M Saeed Sheikh in Issue 6 of May 1980

This article was straightforward in its approach and explained the benefits in simple terms of microcomputers

Now that microcomputers are with us in a big way I feel we should all be educated further in this field and Mr Sheikh s article certainly does this

Thank you for an informative and professional magazine

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On the right lines (1)

Yours is the first decent magazine I have come across dealing with the computer in its various environments Your current mix of

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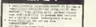

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▶

articles is good but a little more technical information and explanation would be appreciated

Harry A Cannon, 113 Glasnevin Park,
Glasnevin, Dublin 11 Ireland

On the right lines (2)

Having just read your latest issue (6), I was delighted to discover how articulate and lucid its articles were Well done! At last a computer magazine has been produced that is not cluttered with the illiterate abbreviated jargon that seems to plague so many similar periodicals

J M Brown, 13, Strawberry Hill Road,
Strawberry Hill, Twickenham Middlesex,
TW1 4QB

Sinclair's fans

A group of ZX-80 owners in London have formed the ZX 80 Users Club The group's main aim is to create and share programmes written in Sinclair BASIC to fit in the 1K RAM provided with the computer

Membership of the club is free The club is currently distributing its first newsletter which includes a look at press reactions to the ZX 80, a couple of simple games programmes and a questionnaire to find out what sort of programmes members are interested in

Any mention you could give to the club would be appreciated The club's address. ZX-80 Users Club C/ Tim Hartnell 93 Corringham Road, London W12 (s a e with inquiries please)

T Hartnell

▶ *continued from page 74*

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